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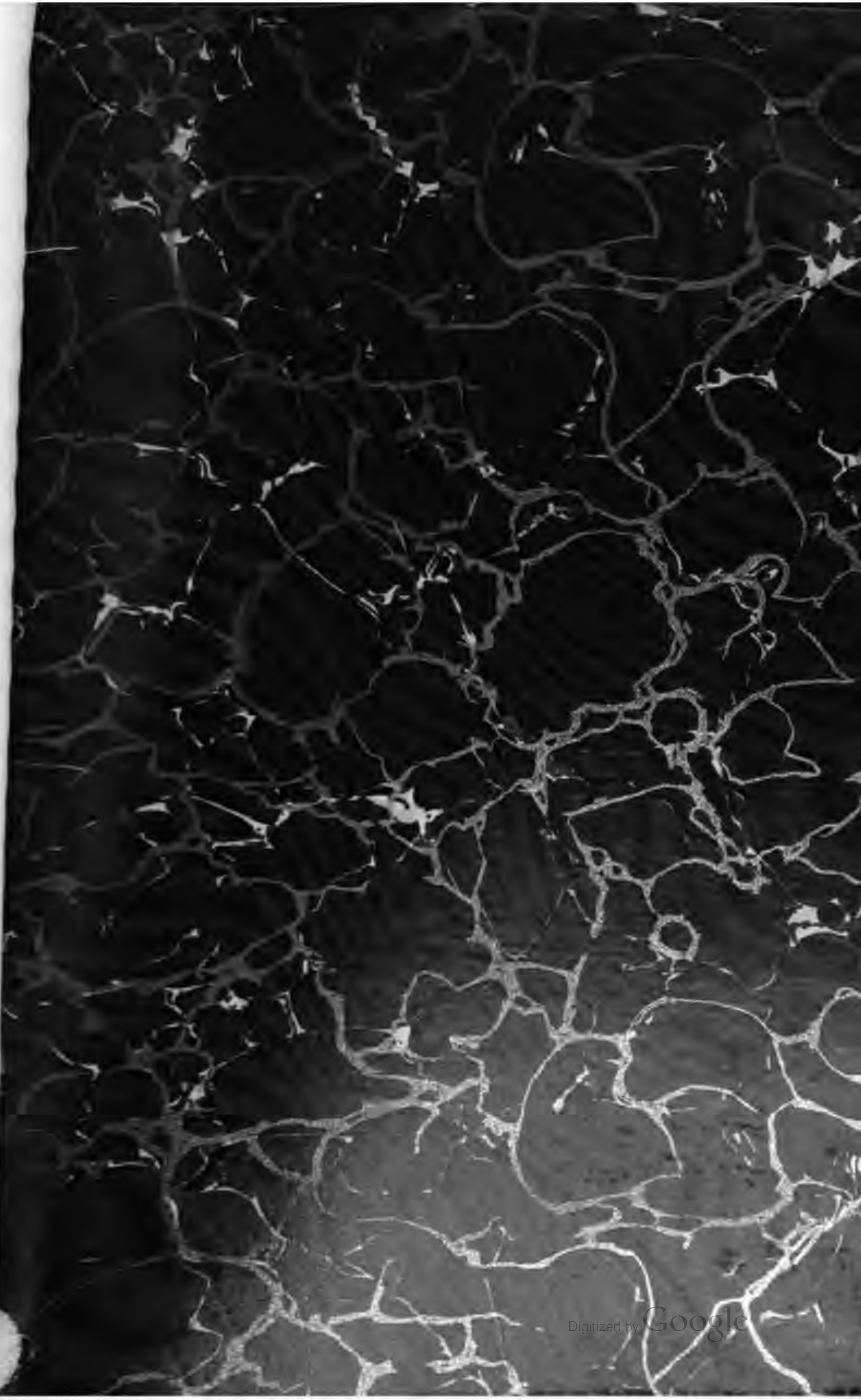

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PREFACE

The International Library of Technology is the outgrowth of a large and increasing demand that has arisen for the Reference Libraries of the International Correspondence Schools on the part of those who are not students of the Schools. As the volumes composing this Library are all printed from the same plates used in printing the Reference Libraries above mentioned, a few words are necessary regarding the scope and purpose of the instruction imparted to the students of—and the class of students taught by—these Schools, in order to afford a clear understanding of their salient and unique features.

The only requirement for admission to any of the courses offered by the International Correspondence Schools, is that the applicant shall be able to read the English language and to write it sufficiently well to make his written answers to the questions asked him intelligible. Each course is complete in itself, and no textbooks are required other than those prepared by the Schools for the particular course selected. The students themselves are from every class, trade, and profession and from every country; they are, almost without exception, busily engaged in some vocation, and can spare but little time for study, and that usually outside of their regular working hours. The information desired is such as can be immediately applied in practice, so that the student may be enabled to exchange his present vocation for a more congenial one, or to rise to a higher level in the one he now pursues. Furthermore, he wishes to obtain a good working knowledge of the subjects treated in the shortest time and in the most direct manner possible.

In meeting these requirements, we have produced a set of books that in many respects, and particularly in the general plan followed, are absolutely unique. In the majority of subjects treated the knowledge of mathematics required is limited to the simplest principles of arithmetic and mensuration, and in no case is any greater knowledge of mathematics needed than the simplest elementary principles of algebra, geometry, and trigonometry, with a thorough, practical acquaintance with the use of the logarithmic table. To effect this result, derivations of rules and formulas are omitted, but thorough and complete instructions are given regarding how, when, and under what circumstances any particular rule, formula, or process should be applied; and whenever possible one or more examples, such as would be likely to arise in actual practice—together with their solutions—are given to illustrate and explain its application.

In preparing these textbooks, it has been our constant endeavor to view the matter from the student's standpoint, and to try and anticipate everything that would cause him trouble. The utmost pains have been taken to avoid and correct any and all ambiguous expressions—both those due to faulty rhetoric and those due to insufficiency of statement or explanation. As the best way to make a statement, explanation, or description clear is to give a picture or a diagram in connection with it, illustrations have been used almost without limit. The illustrations have in all cases been adapted to the requirements of the text, and projections and sections or outline, partially shaded, or full-shaded perspectives have been used, according to which will best produce the desired results. Half-tones have been used rather sparingly, except in those cases where the general effect is desired rather than the actual details.

It is obvious that books prepared along the lines mentioned must not only be clear and concise beyond anything heretofore attempted, but they must also possess unequaled value for reference purposes. They not only give the maximum of information in a minimum space, but this information is so ingeniously arranged and correlated, and the indexes are so full and complete, that it can at once be made available to the reader. The numerous examples and explanatory remarks, together with the absence of long demonstrations and abstruse mathematical calculations, are of great assistance in helping one to select the proper formula, method, or process and in teaching him how and when it should be used.

Two volumes of this library, of which this is the first, deal with poultry farming. In the present volume, the fundamental parts of the subject are treated, the topics covered being poultry houses, feeding, incubation, brooding, laying hens, market eggs, and market poultry. Many types of houses are shown and detailed information regarding their construction is given. Poultry feeding, one of the most important and yet one of the most difficult subjects to master, is dealt with in such a complete, lucid, and painstaking manner that many prominent poultrymen have commented very favorably upon it. All of the important steps in incubation and brooding, both natural and artificial, are fully dealt with, and the difficulties that the novice will encounter in these complicated processes are anticipated and fully explained. The work of producing eggs and the various kinds of poultry for market is taken up from the practical point of view, and the experience gained on many large farms is embodied. This volume, together with the succeeding volume treating on this subject, forms the most thoroughly up-to-date and practical work that has yet appeared on poultry farming.

The method of numbering the pages, cuts, articles, etc. is such that each subject or part, when the subject is divided into two or more parts, is complete in itself; hence, in order to make the index intelligible, it was necessary to give each subject or part a number. This number is placed at the top of each page, on the headline, opposite the page number; and to distinguish it from the page number it is preceded by the printer's section mark (§). Consequenty, a reference such as § 16, page 26, will be readily found by looking along the inside egdes of the headlines until § 16 is found, and then through § 16 until page 26 is found.

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POULTRY HOUSES

(PART 1)

REQUIREMENTS FOR SUCCESS

GENERAL CONDITIONS

1. Dampness.—The first requisite for securing the health of poultry of all kinds is a perfectly dry poultry plant. Dampness in poultry houses is often caused by the gathering on the floors of moisture coming from the ground below the surface drainage. Then, too, if water from rain or melting snow is permitted to run toward the house, it is sure to prove detrimental to the health of the fowls. The most dangerous of all conditions, however, is created during the winter months, when the moisture that evaporates from the excrement, damp floors, and breath of the fowls during the heat of the day is, by the severe cold of the night, congealed on the ceiling, side walls, and window panes of the house. If the conditions in the poultry house are such as to produce dampness, there will be among the flock many ailments, such as colds, catarrh, bronchitis, roup, and the other ills that are the natural result of just such surroundings. To avoid these evils, numerous plans have been devised to keep the buildings dry, the most successful of which are proper drainage and the use of damp-resisting floors of some kind that will prevent moisture from coming up from below. In addition, poultry houses are often provided with open fronts. Such openings are closed during bad weather with a cloth curtain, through which there will be a free circulation

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of air into the house and throughout its interior. The fresh air entering the poultry house absorbs, or dries up, the moisture, with the result that the temperature is from 6 to 10 degrees warmer inside of the building than it is outside.

2. Poultry buildings should be so located that there will be little danger of dampness. Ground having a surface that naturally sheds water away from the building is preferable, and if there is a sandy or a gravelly subsoil underlying the soil, the drainage will be complete. If these conditions are not present, however, surface drainage and underdrainage must be resorted to in order to remove the surplus moisture and thus insure a dry floor in the interior of the poultry house.

3. Surface Soil.—The best kind of soil on which to build a poultry house is a sandy loam having a sandy or a gravelly subsoil. Both the soil and the subsoil should be deep enough to permit perfect drainage. On soil of this kind, all infection and filth that may be present on the surface can be carried away. Soil of this nature may be easily cleaned on the surface with a rake or a hoe. If the poultry plant is a large one, a light plow or a cultivator pulled by a horse can be used to advantage in stirring the surface soil; or a harrow pulled by a team may be used to loosen the hardened surface. Then, when rain falls on soil treated in this manner, it washes away all infectious and unhealthful matter. Cleanliness is absolutely essential for yards and runways in which fowls are confined.

4. Where the lay of the land, surface soil, and undersoil do not permit of the most desirable natural location, the most elevated site that can be used for poultry buildings should be chosen. These buildings should be placed to the best possible advantage, and the grounds should be improved as much as possible by means of either surface drainage or underdrainage, or both. When the wash of the land is toward the buildings, it is advisable to dig drains and build banks so as to turn the water away from the yards and houses. In addition, the buildings should be placed with reference to having the most sunlight that can be obtained through the windows. These precautions, together with those previously mentioned, will improve undesirable locations and will remove to a large degree the dangers arising from dampness.

5. **Exposure.**—A hillside sloping gradually toward the south, is the most desirable location for all poultry buildings. This, of course, applies to places situated in the northern hemisphere. In the southern hemisphere, the exposure should be exactly opposite. When such a location has a gravelly subsoil and a sandy loam top soil that produces a strong growth of grass and other green stuff, it provides the ideal spot for poultry buildings. The incline of the land should be slight—just enough for perfect surface drainage. Buildings for poultry can be erected upon such a site with full assurance of success so far as location goes. A steep or moderately steep hillside is not so suitable, but it can be used successfully if the right conditions are provided artificially. If yards are to be used, they should be located in front of the building and should extend away from it in a southerly direction. If the natural drainage is not good, a drainage wall should be erected in the rear of the building so as to prevent surface water from going down into or from coming up through the floor of the house. If poultry houses can be located within a shelter of trees or with a hillside on the north, the best natural protection from winds and storms will be secured. A forest toward the north and near the poultry plant is also an advantage, both as a protection from storms and as a range for the fowls; yet, at the same time, a forest may prove to be a dangerous surrounding, owing to the enemies of poultry, such as minks, weasels, opossums, etc., that it may harbor. A stream of pure water running through or near the poultry plant is also of great advantage as a natural water supply for the fowls; but stagnant water must always be avoided.

6. **Surface Drainage.**—In a poultry plant, it is extremely important to get rid of the surface water. For this purpose,

either open ditches, through which the surplus water will be carried away from the yards, or a drainage system consisting of dry wells should be provided. Dry wells are made by digging holes in the ground until a gravel bottom is reached and then filling up the holes with stones, using large stones first, then smaller ones, then still smaller ones, and finally filling the upper part, to the level of the surrounding soil, with very small stones or gravel. The ground is then graded so that the surface water will drain into the well. In this way, an escape is provided for the surplus water that will drain away. Hard pan or heavy clay soil near the surface accumulates and holds so much water that the soil dries out very slowly. A foot or two of hard pan beneath the surface is equally injurious to healthful conditions, and in order to drain it successfully with dry wells, they must go below the hard clay into sand or gravel. It is never advisable to locate a poultry plant on low-lying, boggy, wet land or on hard pan that is too costly to underdrain.

7. Underdrainage.—A poultry plant that is located on land, the surface and top soil of which are porous enough to permit the water to filter through them, can be successfully underdrained. The drain pipes should be laid below the frost line to insure safety to the tile, and there should be enough of them used to secure good drainage. Water from rains or melting snows and ice will soak down through the soil and be carrried away through the tile. Such drainage is of great benefit to a poultry plant.

Terra-cotta bell pipe should be laid underground so as to carry away water that reaches the ground through waterspouts from the roof. These pipes, too, must be laid below the frost line in order to protect them and to insure their safety. The end of one pipe fits in the bell of the next pipe, and in this way prevents the pipes from being displaced.

The best drainage, however, is that provided by nature in the way of a sandy loam top soil with a sandy or a gravelly subsoil. Whenever it is possible to do so it is preferable to select ground of this kind rather than to attempt to improve poor conditions. The additional expense and labor incurred in caring for poultry in undesirable places often deprives the poultryman of profit that might be gained through the same effort expended in a proper location.

NATURAL REQUIREMENTS

8. **Height of Buildings.**—The natural demands of a hen are about the same as those of a dairy cow, except those due to the difference resulting from size. The hen varies, according to the breed, from 9 to 12 inches in height, and it should furnish enough natural, or body, heat to make comfortable a space 2 feet long, 2 feet wide, and 7 feet high. If the hen is to be cared for in proportion to its size and weight, a poultry building, for the comfort of the hen in winter, should be only 2 feet high inside. However, this height would be impracticable, because the needs of the attendant in caring for the hen must be taken into consideration even more than the needs of the hen herself. If this were not done, the hen could not be looked after, nor could its dwelling place be properly cared for. For these reasons, it is necessary to plan and arrange the most comfortable quarters possible, based almost entirely on the needs of the hen and the care necessary for the interior of the buildings. Buildings for poultry, then, should have sufficient height inside for the attendant to move about, and, as a rule, 7 feet in the clear is the average height from the floor to the ceiling at the highest point.

9. **Floor Space.**—In constructing houses for breeds of medium or small size, such as Leghorns, Minorcas, or Bantams, it is well to allow 4 square feet of floor space for each fowl. For example, fifteen fowls of this kind should have 60 square feet of floor space, and twenty-five fowls, 100 square feet. On the other hand, a floor space of 5 square feet should always be allowed for a Plymouth Rock or a Wyandotte, and one of 6 square feet for a Cochin or a Brahma. Thus, while a 10′ × 12′ building, which provides 120 square feet of floor space, is sufficiently large for thirty Leghorns, it will house

only twenty-four Plymouth Rocks or Wyandottes, or only twenty Cochins or Brahmas.

10. Shape of Buildings.—So far as economy of construction is concerned, it is generally advisable to make a house as nearly square as possible. In poultry houses, however, the advantage of the square house is outweighed by other considerations, such as good, natural lighting and ventilation, which can be obtained in large houses only by making them relatively long and narrow. They should not be made too narrow, however. Under ordinary conditions, the width should not be less than 12 feet, as floor space in narrow buildings is costly. For example, a building 8 ft. × 100 ft. would cost at least three-fourths as much as one 16 ft. × 100 ft., and would furnish only one-half the floor space. If large houses are required, they should be made from 16 to 20 feet in width and long enough to shelter the desired number of fowls.

11. Light.—Sunlight is an absolute necessity for the health of fowls. For this reason, the buildings should be located so that the sun may shine into the windows for the greatest number of hours each day during the winter months. In the northern hemisphere, therefore, they should face either directly toward the south or be slightly turned toward the southeast. If possible, it is well to make observations from the first of November to the end of March, and in this way determine the angle at which the building should be placed so as to insure the greatest number of hours of sunshine per day into the poultry house during the winter months. When impossible to locate the buildings so that they will face the south, they should be placed so as to have all the sunshine possible.

POULTRY-HOUSE CONSTRUCTION

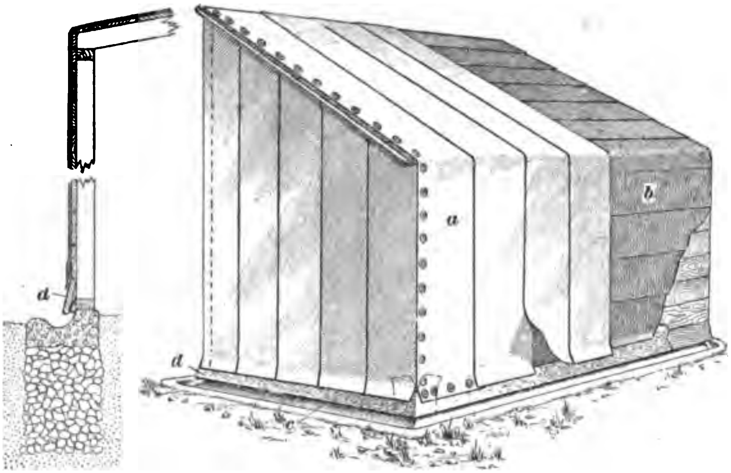
MATERIALS, ROOFS, AND FOUNDATIONS

MATERIALS

12. Lumber for Poultry Houses.—For light construction, 2″×2″ uprights should be used with a 2″×4″ sill. This kind of construction will answer for small or individual buildings or for any style of poultry building that is not to be permanent, provided it is strong enough to bear the weight of the roof when there is a heavy fall of snow on it. A much more substantial framing, however, can be made of 2″×4″ studs and a 4″×6″ sill. Either barn boards, beveled siding, or jointed flooring having a 6-inch face should be used for siding. If barn boards are used, they should always be dressed on one side, the same as the siding or flooring, so as to provide an even outer surface to the building. Either pine, hemlock, or poplar lumber is good for framing and siding, while pine or cypress should be used for the flooring. In choosing lumber for poultry houses, it is always a good plan to select the kind of lumber that is least expensive, provided it will make a perfectly air-tight construction of three sides to exclude drafts.

13. Materials for Side Walls.—In very cold climates, double siding with one or two thicknesses of tar paper between is sometimes laid on the north wall of poultry houses. It is not unusual to place tar paper beneath the one layer of siding. In such cases, however, the surface of the paper not only acts as a gathering place for dust and dirt but also serves to harbor insect vermin. Such condition may be greatly prevented by sheathing the interior with flooring or by plastering the walls and ceilings. Brick or cement can be used for the side walls, but, when used, it is difficult, without the aid of artificial heat, to keep the interior dry. Dampness, as has been stated, is always undesirable for poultry. The use of lumber gives more satisfactory interior conditions and is always preferable; brick and cement walls have not proved satisfactory.

14. Building Paper.—The use of **building paper** between walls and floors is highly recommended on account of the value of this material as a non-conductor of heat and as a protector from cold and drafts. Many kinds of paper, ranging from tar paper to the heavier grades of building paper, are used for this purpose. Any of these papers will last a long time if they are carefully laid against a reasonably smooth surface. Tar paper forms a protection from insects, and for this reason it is often selected. Three-ply roofing paper or three-ply roofing felt is the cheapest of these materials that can be used to advantage for the roof or the side walls, and if it is of good quality and properly laid, it will last for many years. When improperly laid and of a poor quality,



(b) (a)

FIG. 1

however, it is not desirable. Roofing felt must be laid close and tight to the roof or side walls by tarring the edges, lapping them, and fastening them down well with nails and caps so that no wind, water, or snow can enter the house. Every crack or opening in the roof becomes a catch-basin for dampness instead of a protection from it.

All kinds of roofing papers will prove to be more satisfactory if they are laid with hot tar or some liquid preparation that will cause the paper to adhere to the boards. In addition to the liquid preparation, nails with tin caps must be used to hold the paper tight and firm in position, as just explained. Nothing less than a 2-inch lap of one piece of paper over the other should be allowed.

15. In Fig. 1 are shown the roof and sides of a poultry house covered with roofing paper. The roof is built without projecting over the side, and the edges of the eaves are rounded so that the paper will fit smoothly where the roof and the side meet. The first layer of paper consists of ordinary red roofing or tar paper laid horizontally on the sheathing, as shown at *b*. On top of this paper, three-ply roofing felt is placed in the manner shown at *a*, the whole being fastened in place with nails and caps, as described in the preceding article. A slanting baseboard *d*, covered with felt, shown in both (*a*) and (*b*), is placed at the base of the house, and a cement gutter *c* is built around the outside of the foundation. This gutter opens into a terra-cotta drain pipe, through which all water coming from the roof and sides, quickly flows away. Since the roof has no projection, rain water or melted snow will run down the sides without the aid of an eaves trough. This water is turned away from the foundation by the baseboard into the gutter, from which it easily drains into the terra-cotta pipe. With this type of construction all danger of the ground about the house being washed away is prevented.

A well-constructed house of this style has a good air-tight roof and sides, can be easily and cheaply built, and under ordinary conditions will last for many years.

16. Shingles.—A good covering for poultry buildings may be made of **shingles.** They may be laid on strip sheathing, which is usually made of boards a foot wide and an inch thick, or on roofing lath, which is not nearly so expensive as the close sheathing. If good shingles are used and the roof is properly laid, it should do service as long as the building lasts. The life of a shingle roof may be prolonged by giving the roof a steep pitch. If the pitch is steep, the roof will drain more quickly and the material will be less likely to become water-soaked. In this way, the danger of its destruction through mold or decay caused by dampness is lessened. If, however, the shingles are of a poor quality and turn up at the ends, snow and wind will get into the poultry house.

17. Dirt Floors.—Floors made of dirt may be used in poultry houses, provided the drainage is good and there is little danger from rats. Damp clay should be used in making dirt floors. This material should be well tamped, moistened, and then tamped again until level, hard, and smooth. Floors made in this way can be kept in a sanitary condition for a long time by sprinkling them with fresh dry dirt or clean sand each time that the house is swept or cleaned. Sifted coal ashes mixed with wet clay in the proportion of 1 part ashes and 2 parts clay, and well tamped with a heavy tamper, also make a very good floor. A tamper can be made by fitting a round handle into a block of wood. The block should be about 6 or 8 inches square and a foot long, and the handle about 3 feet long and 1½ inches in diameter. A hole to a depth of 3 or 4 inches should be bored into the center of one end of the block by means of a 1½-inch auger and the handle then driven into place.

18. Board Floors.—Floors made of boards laid upon 2″×4″ joists set on edge and filled between with dirt are soon undermined by rats. When using boards, it is well to fill in between the joists with cement filling or to cover them beneath the floor with close, galvanized-wire cloth or with steel lathing, so as to keep out the rats. If floors are raised far enough above the ground to permit dogs and cats to go beneath them there will be scarcely any danger from rats. Elevating the board floor above the ground also prevents to a limited extent the expansion and contraction that is caused by alternate damp and dry conditions. A board floor should be made of perfectly dry, well-seasoned, tongued-and-grooved lumber, with the edges laid smooth and level. Underneath the floor should be placed a layer of three-ply tar paper, and the tongue and groove of the flooring should be smeared with hot tar before the boards are nailed into place. This practice is often dispensed with; nevertheless, the use of tar for this purpose always pays.

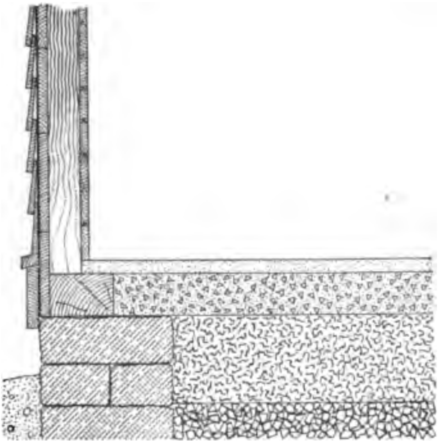


FIG. 2

19. Cement Floors. Well-laid **cement floors** are decidedly the best for all kinds of poultry buildings. The cost makes them prohibitive in some instances, but since most farmers at the present time can do plain cementing, they are used extensively. Cement floors should consist of four layers, as shown in Fig. 2. The bottom layer should be made up of stones, and the next layer of about 8 inches of coal cinders or gravel. On top of this, to within 1 inch of the top should be placed 3 or 4 inches of concrete. The top layer of the floor should consist of cement and sand—1 part of good cement to 2 parts of sand, or better still, 1 part of each. In making cement floors, each layer of filling as completed should be moistened and well tamped. The color may be darkened with lampblack if desired. A practice that has recently come into use is to coat the concrete with hot coal tar just before the layer of cement is put down. On top of the hot tar is laid three-ply felt, and on top of this is applied another coating of hot tar. The cement finish is then laid over the layers of tar and felt, which prevent cold or dampness from coming up through the cement. If desired, the top covering of cement can be dispensed with, and the concrete filled 'in and tamped until the moisture, or thin portion, is brought to the surface. When dry, concrete tamped in this manner furnishes a fairly smooth floor, but not such a perfectly level nor smooth one as can be obtained with cement and sand. Good concrete can be made of 5 parts of sand, 2 parts of gravel, and 1 part of cement. Portland cement is preferable. The gravel, or coal ashes, whichever is used in making the second layer, should be moistened and well tamped. This kind of a floor is a perfect protection against rats.

If the cement floor is laid prior to the construction of the building, it should extend 3 or 4 inches outside of the ground framework, and the building should be set on top of sills that have been laid in the cement. Cement floors are rough and hard and are cold in winter. For these reasons, a covering of straw should be kept upon the floor; also, the roosts should be set close to the floor so that the fowls when leaving them will not light heavily upon their feet. When cost need not be considered, asphalt, such as is used for paving, may be used for the top coat. A floor made of asphalt will be neither so hard nor so cold as one made of cement.

ROOFS AND FOUNDATIONS

20. Shed Roof.—The slanting roof shown in Fig. 3 besides being the most economical is the one most frequently used for small poultry houses. This type of roof, called the **shed roof,** may be made of rough barn boards covered with tar or any other kind of roofing paper; or, it may be made of well-selected flooring boards laid lengthwise. In the latter construction, the boards should be joined with hot tar and well covered with either iron paint or hot tar. When thus covered with tar or paint, no other covering is needed.

The roof may also be made of planed barn boards covered with either tar paper, three-ply roofing paper, shingles, corrugated iron, or tin.

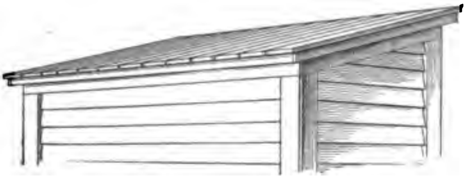


Fig. 3

21. Gable Roof. The **A-shaped,** or **gable roof,** shown in Fig. 4, is used for large poultry buildings. This type of roof is substantial, but it is not generally used for poultry houses because it creates more open space overhead than is desirable during cold weather. However, when the ceiling is ceiled over and a loft left above, the interior of the building is warmer in winter and cooler in summer than when other types of roofs are employed. The loft can be used to store litter during the winter, and during the summer it will serve as a ventilator. The ceiling should be stripped, leaving 4-inch openings between each strip. Then, when the loft is filled with straw, the straw will absorb the surplus moisture from the room below. On clear and pleasant days during cold weather, the windows at either end of the loft should be left open, so as to permit a current of air to pass through and over the straw. In this way, the straw will be freed from the moisture and will be in good condition to absorb the dampness that will arise continually from the pen below.

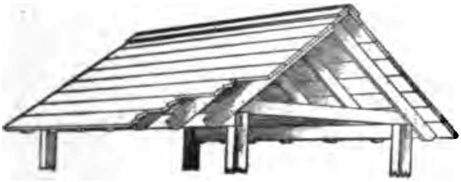


Fig. 4

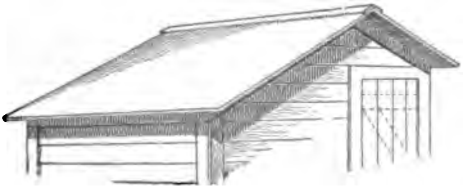


Fig. 5

22. Double-Slant Roof.—The **double-slant roof,** shown in Fig. 5, is especially desirable for connected apartment houses, which are described later. The longer side, or front part, of this roof should face the south, while the shorter side, or back part, should face the north. Under the back part is a passageway into which a door opens. This type of roof should be given particular attention, because it is well adapted to long buildings. It can be covered with any of the roofing materials previously mentioned.

23. **Double Roof.**—The **double roof,** shown in Fig. 6, can be used in localities in which it is necessary during cold weather to house continually a large number of fowls in a building having only limited floor space. To get sufficient light within the house, sashes should be placed in both the roof and the side wall, as shown in Fig. 26, which illustrates the double roof. A double roof should be carefully constructed and should be covered with shingles. The roof windows should rest upon a framework, to prevent the possibility of leakage. The openings for the roof windows should be framed above the roof, and the sashes should extend over the frame an inch all around. This arrangement will prevent wind, rain, or snow from entering the house through the windows in the roof.

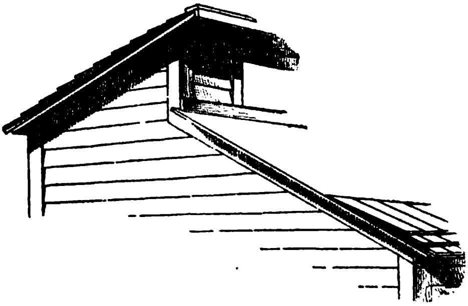


Fig. 6

24. **Construction of Foundations.**—Poultry houses may be built directly upon the ground with the sills resting upon loose stones or brick, or they may rest upon heavy wooden sills 4 in.×4 in. or larger that have been coated with tar. It is better to boil the tar and apply it while hot, as it then makes a good wood preservative. Such foundations, however, are not desirable, because contact with the ground causes the sills to rot and, besides, rats work through the loose stones and undermine the floors. Either bricks or stones

laid with cement make a better foundation. Sills 4 in. × 4 in. or larger set upon concrete or laid into the concrete floors, provide the most substantial groundwork upon which to place the buildings. When buildings are intended for continuous service, it is most economical to build them upon foundations that will last. Therefore, the sills should be protected from dampness, and the floors should be made of material that will prevent rats from undermining them. While economical expenditures are to be commended at all times and under all conditions, especially when building poultry houses, it must not be taken to mean that any kind of a house is good enough for poultry. Both care in construction and economy in the use of material should be exercised.

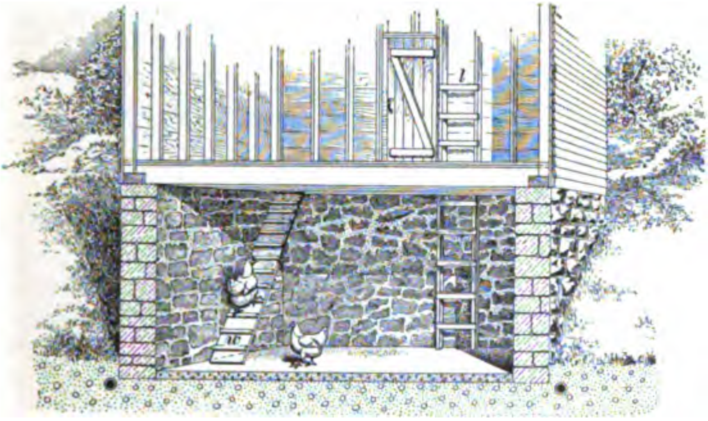


FIG. 7

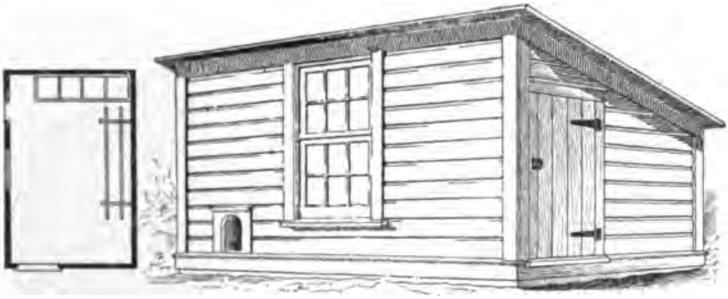
25. Hillside Foundations.—Poultry houses that are to be built on a hillside should have foundations made of concrete or of stone or brick laid in cement. A foundation of this kind provides a surface footing for the framework, which can be supported in front or in several places by posts built of the same material as that which is used in the walls or by heavy upright posts of cedar, locust, chestnut, or any other wood that lasts well in the ground. The flooring should be laid above the surface level of the ground at the rear of the building. An open or enclosed scratch shed can, if desired, be provided beneath the building, as shown in Fig. 7. When the poultry house is elevated in this way, a stairway or a permanent ladder *l* for the attendant's use should lead from the basement to the room above; also, a board ladder *w* for the use of the hens, should lead into the roosting and laying rooms. The chief disadvantage of this style of building is that during winter the circulation of air beneath the floors is likely to be too free; but the ill effects of this may be lessened by laying a double floor above, with three-ply tar paper in between the flooring. If the basement, or scratch shed, below is enclosed during winter, it will prevent, to a very great extent, the cold drafts of air from getting into the house above.

SMALL HOUSES

26. Poultry houses should have all the conveniences that will lessen the labor of caring for them and for the fowls, since the more quickly and easily the labor of cleaning and feeding can be accomplished, the better and cheaper it will be done. The interior fittings of all kinds of poultry buildings should be plain, substantial, smooth of construction, and as free as possible from cracks or crevices. Besides, all furnishings or equipments should be so placed that they can be readily removed for cleaning. Cracks and crevices make abodes for insect vermin, and when red mites, the most troublesome insects of all, become established in such places, it is very difficult to dislodge them. The poultryman should therefore prevent their presence, as far as possible, by erecting and equipping buildings in the manner just outlined.

ONE- AND TWO-ROOM HOUSES

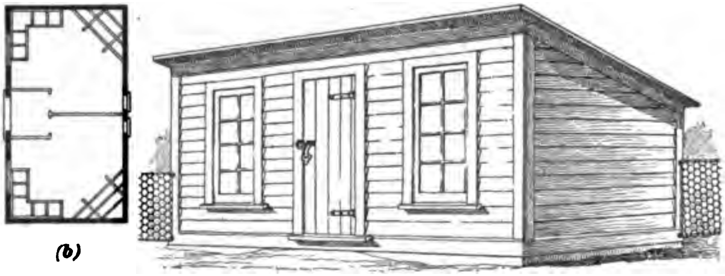
27. One-Room House.—The **single-** or **one-room house** is used when it is desired to accommodate only a few fowls. This style of house can be handsomely built and furnished, or it can be cheaply built and equipped. It should have a slanting roof, which, preferably, should shed to the north, so that the windows in front may face the south. In Fig. 8 (*a*) is shown the exterior of a one-room house, while in (*b*) is shown the floor plan. A building of this kind that is 8 feet wide and 10 feet long, since it has 80 square feet of floor space, provides sufficient accommodation for from sixteen to twenty fowls. If such a building is to be of light construction, the framework may consist of 2″ × 2″ hemlock studs, but 2″ × 4″ studs are better, as they make a much more substantial house. The framework should be covered with either barn boards, beveled siding, or rough flooring, that is 6 inches wide. Lumber that is dressed on one side is always preferable, because the smooth side can be painted more easily than rough boards. If barn boards are used for siding, the cracks should be closed with 2-inch strips, and if siding is made to serve, it should be nailed together thoroughly and closely. The roof may be constructed, as previously described, to meet the requirements of the owner. This type of building can be supplied with any or all conveniences, and the windows may be of glass, cloth, or woven wire.



(*b*) (*a*)

Fig. 8

28. Two-Room House.—The small **double-** or **two-room house** is for the accommodation of two lots of fowls that are separated into breeding pens. It is intended for the town lot, the suburban home, or the farm, or for housing poultry that is being fattened for market. The two-room house shown in Fig. 9 (*a*) has two windows and a door in front, while in the rear and leading to an open yard are two small openings through which the poultry may pass when going into and out of the house. The floor plan of this building is shown in (*b*). When yards are used for confining fowls, the house may be placed directly in front of the enclosed yards or runways, or it may be placed inside of the yard in which the poultry is kept; also, such a house may be placed in an open field or some other convenient place. If the house is placed directly in front and outside of the poultry yard, the fowls should pass into and out of it at the north, from the rear of the building, a fence alone separating them.



(*b*)

(*a*)

Fig. 9

Such a house may be made attractive in appearance, the windows, doors, and siding all being selected for the purpose. During the summer months, the windows may have a hood, or shelter, over them. These hoods should be so arranged that they can be turned up out of the way or removed entirely during the winter months and thus permit the free access of sunlight. If preferred, the window sashes may be removed and wire screens or frames covered with muslin put in their place. When a house of this kind is used on the farm for a flock of fowls, all partitions should be omitted, and the entire house made to serve both as a laying and as a roosting room.

HOUSES WITH SCRATCHING SHEDS

29. Combination House.—The **combination house,** illustrated in Fig. 10, is provided with a scratching apartment, in which the nests are located, and a roosting room. This style of house is especially adapted for farms and other places where fowls have a free range in flocks. One advantage of the combination house is that it provides comfortable quarters for the fowls. The scratching apartment is located in the door end of the building, and the roosting apartment in the other. Such buildings are usually made 16 feet wide and 24 feet long, with a partition just in front of the side window near the rear. This window *c* need be only large enough to admit sufficient light for the fowls when going to roost or coming therefrom. The roosting room should have six strong roosts extending the full width of the building, and each roost should be 2 inches across the top and 4 inches thick. It will not be necessary to have more than 2 feet of open space in front of the roosts toward the partition. A dropping-board is not required in a house of this kind; but, if omitted, the floor beneath the roost must be covered with dry earth or sand, so that the droppings can be gathered with a rake or a hoe. When the droppings are removed, the ground should be stirred and freshened with new earth so as to keep the interior of the building sanitary. The fowls go into and out of the building through the door in front.

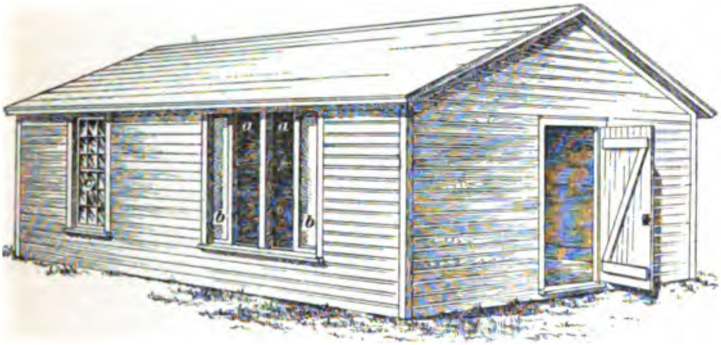


Fig. 10

30. The two large window openings shown at *a*, Fig. 10, are fitted with sliding frames *b* that are covered with either muslin or white duck. Such window coverings assure ventilation when the doors and windows of the building are closed. These sliding frames should be kept closed during cold weather, or when the weather is wet. The door that is used as an entrance for the fowls should be kept open constantly during the day, but it should be kept closed at night. During the warm months of the year, a wire-screen door should be used in place of the solid door, and the sliding frame should be pushed back and the window openings covered with woven wire. This arrangement will assure protection for the fowls from small animals that might destroy them, and will also permit a free circulation of air. The glass window *c* near the roost must be closed at all times, since the object of this window is not to ventilate, but to admit light.

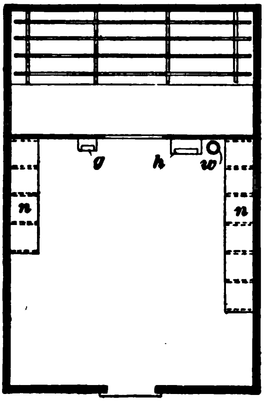


FIG. 11

A ventilating door that can be opened or closed from the outside, should be placed in the rear of the house, close up to the peak of the roof. This ventilator should be kept open except when the nights are cool or cold. When the ventilator is open, a current of air will pass above the heads of the fowls upon the roosts, and thus keep the roosting room cool. However, such an air-current may prove injurious to the fowls on cool or cold nights, and for this reason the ventilator should be shut on such nights.

31. The floor space of the combination house is divided as shown in Fig. 11. In the rear is a room 16 ft.×8 ft. for the roosting place. The front room is 16 feet square and contains the nest boxes, feed-hoppers, and scratching floor. The front room, which is really an enclosed scratching apartment, is valuable during winter weather, as it helps the egg yield. The floor of the house may be any one of the several kinds previously described, although the best kind is made of solid cement throughout.

32. As shown in Fig. 12, the partition wall *a* of the combination house is made of matched flooring. In the center of the partition is a door and above it is woven wire. The door consists of framework placed above a wooden sill, the framework being covered with unbleached muslin. The small opening *o* in the lower part of the door permits the fowls that get off the roost early in the morning to leave the roosting room before the door itself is opened. Appliances for holding feed and water are placed on each side of the doorway. At the right of the door is a large-sized hopper *h* for grain and a drinking fountain *w*; at the left is a small hopper *g* for beef scrap, grit, or oyster shells. Nest boxes *n* are placed along the side walls both on the right and the left. One nest box for every four hens will suffice. This style of house is both economical and advantageous, is large enough for one hundred and twenty hens that have their freedom during the day, and will prove satisfactory in all kinds of weather.

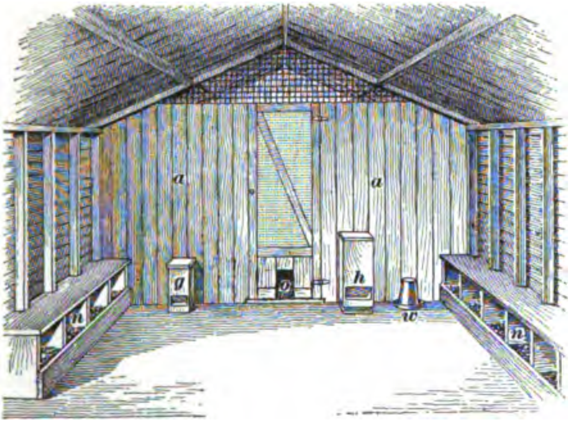
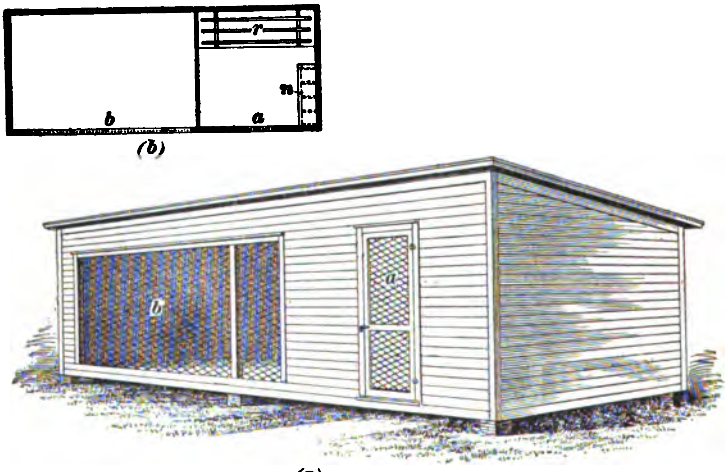


FIG. 12

33. Scratching-Shed Houses.—Houses with scratching sheds are suitable for the farm. A house having one of the several kinds of scratching rooms is best for all localities in which there are likely to be snowfalls and blustering winter weather. The open room under shelter provides a workshop for the hens that is constantly dry, but yet in the open. In Fig. 13 (*a*) is shown an exterior view and in (*b*) the floor plan of one of the many kinds of scratching-shed houses. This house is 12 feet wide and 30 feet long. A room 12 feet square is partitioned off for the laying and roosting place. The room at the left is for the scratching shed, and is 12 feet wide and 18 feet long. The front opening *a* is closed by means of a strong frame door that is covered with woven wire, a curtain of heavy muslin or white duck being tightly drawn over it during the winter. The walls, the roof, and the partition between the rooms are made air-tight, and there is a cloth-covered door between the two rooms. The opening *b* in front of the scratching shed is provided with cloth-covered frames. These frames are hinged inside so that they can be let down over the openings for protection during bad weather. The floors of the building are made of



(*b*)

(*a*)

Fig. 13

dressed, tongued-and-grooved flooring, which is cemented together with hot tar. This building is erected on corner foundations made of brick and cement, and is set high enough

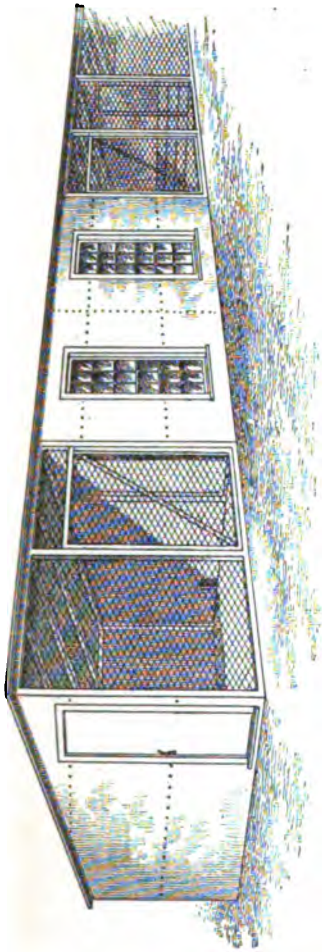


FIG. 14

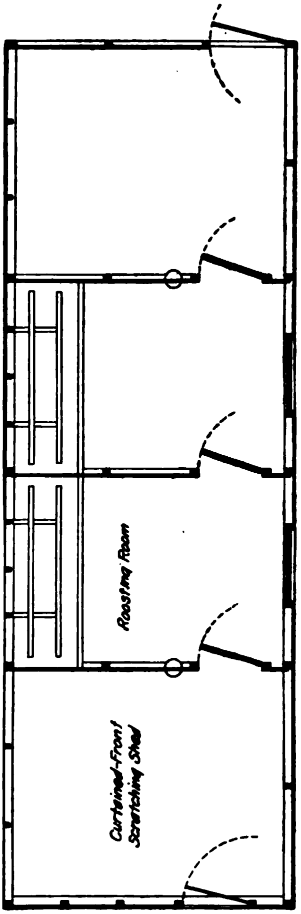


FIG. 15

above the ground to allow cats and small dogs to go under it in order that they may kill rats and other vermin.

34. The scratching shed, or open scratching room, was formerly used as an auxiliary to poultry houses. It was in advance of the present style of open-front houses, which will be described later. In the open room, the fowls may exercise in pure air and still be sheltered from bad weather. The scratching shed may be added to any style of individual poultry house or to both sides of a double house; or, it may be built continuously with connected houses of considerable length. The changes and improvements that have been made do not alter to any extent the original intent, which was to have for the hens an open-air scratching room with protection from the elements.

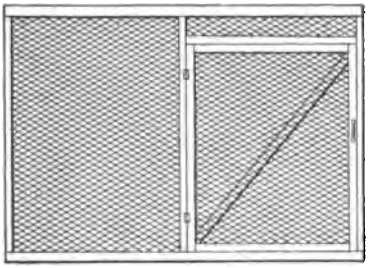


Fig. 16

Figs. 14 and 15 show, respectively, an exterior view and the floor plans of a modern scratching shed and roosting house. This kind of building and shed, in multiples of 36 feet, may be extended to any desired length. The scratching shed, with a 10-foot front, is made 12 feet deep, 7 feet high in the front, and 5 feet high in the rear. The roosting room has an 8-foot front and is 12 feet deep; the whole house has a floor space sufficient for forty hens during the winter months. The windows in the roosting room are of sash and glass, or they may be of cloth. The front of the scratching shed is

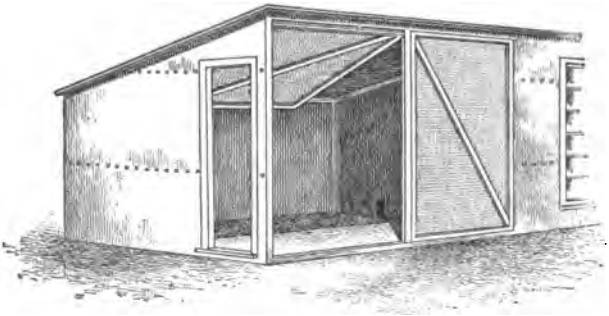


Fig. 17

enclosed with woven wire, as shown in Fig. 16, and inside of this are frames covered with muslin, as shown in Fig. 17. In the latter figure, the woven wire is not shown, so that the cloth screens may be more easily seen. These frames swing back and, when open, are fastened up against the roof. They are kept open at all times except during wet, cold, or snowy weather. The partition that divides the roosting room into two parts is made of boards, as shown in Fig. 18, while the one used between the scratching shed and the roosting room is made of boards and screen wire, as shown in Fig. 19. The plan of construction requires that an open shed be built on both sides of the roosting rooms.

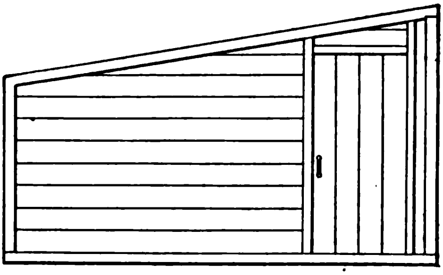


Fig. 18

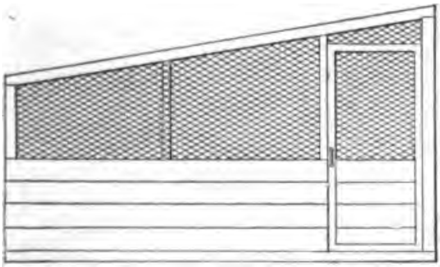


Fig. 19

Since the open-front house has come into use, the scratching-shed house is not regarded with much favor. The open-front house serves all the purposes for which either or both are intended, and will house an equal number of hens quite as well, if not better, and at less cost, so far as buildings and floor space are concerned.

HOUSES WITH CLOTH FRONTS

35. Fresh-Air House.—In Fig. 20 is shown a **fresh-air house** that may be used in mild climates. This house is 12 feet wide and 20 feet deep, and provides 240 square feet of floor space, or sufficient room for about sixty fowls. It is built low in front—about 3 or 4 feet high in the clear—and is 7 feet high in the rear. The double-slant roof provides sufficient height for the interior, and at the same time has a small amount of open space overhead. The front of the house is never closed more than is shown in the illustration. The wire screen and the screen door protect the poultry from dogs and other animals. The screen door in front should be left open during the day, but it should be kept closed at night. Air passes through the open front into the whole house. The door at the side is for the attendant's use, and should be covered with heavy paper or boards during the winter months. The house, being practically air-tight, except in front, will be free from drafts, or currents of air, while the temperature inside of it will differ very little from that outdoors; also, the interior will be dry. This house can be made warmer during the winter by closing the front from the inside by means of frames covered with muslin cloth. The windows, one on each side of the house, should be kept open during hot weather, but should always be closed when it is damp, cool, or cold.

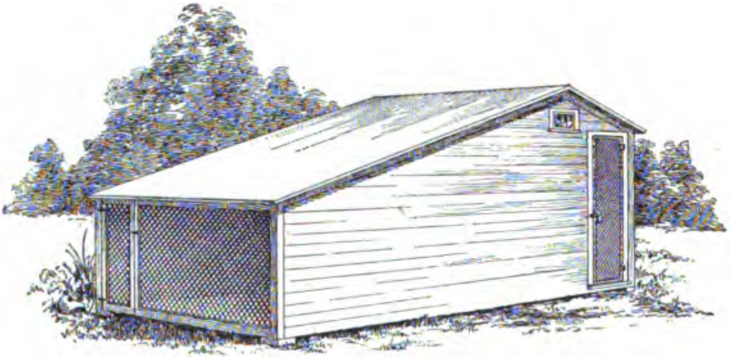


Fig. 20

The fresh-air house, being of low, narrow construction, like a cave, is warmer naturally than a higher and narrower house with an open front; notwithstanding this, it will be scarcely 12 degrees warmer inside of a fresh-air house during a cold night than it is outdoors. The advantage derived from the use of these houses is the close approach to natural conditions in a roosting place for the fowls, although when roosting inside of a house of this kind, they are more sheltered from the elements than when roosting in the open air. The roosting place *r*, as shown in the floor plan, Fig. 21, is far back from the open front, and even if the wind blows directly into the open front, very little of it will pass into the building, as there are no openings elsewhere to form a draft. What influence the wind has is a benefit, since it drives what warmth there is in the building to the rear, and not through the house and out at the other end. The nest boxes *n* are located on both sides of the house.

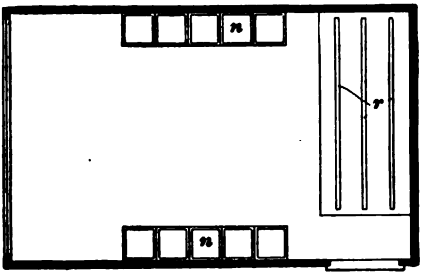


FIG. 21

36. Open-Front House.—When the term **open front** is used to designate a kind of poultry house, it refers to one the window openings of which are closed with cloth, or partly with cloth and partly with glass. This kind of poultry house is most favorably considered at present, but time only can tell whether or not it will prove to be the best. Fig. 22 shows a house that embodies all the valuable features of an open front. It is a two-room house, but the same general plan

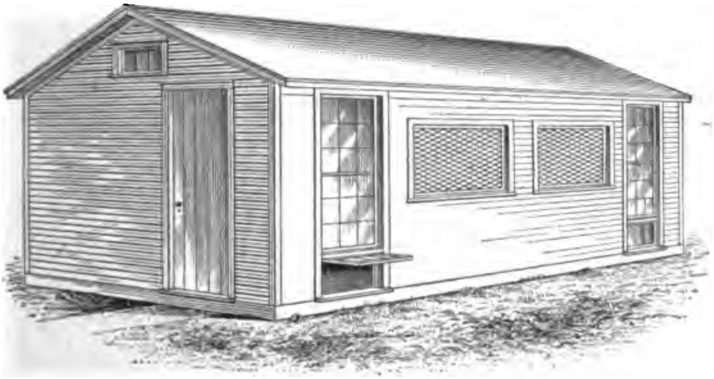


FIG. 22

can be followed in constructing a long house having any number of rooms. The house shown is 6½ feet high in the front and the rear, 9 feet high in the center, 12 feet wide, and 24 feet long. In front, near each end is a sash and glass window, and between these windows are two cloth-covered frames. Each room is 12 feet square, and has one window opening that is closed with glass and one that is closed with cloth. Below each glass window is a smaller hinged-sash and glass window. This low-down window permits the sun to shine on the floor close to the front of the house, and also serves as an opening through which the fowls may pass. The frames on which the cloth is fastened are hinged at the top of the opening so as to turn up inside against the roof, where they are fastened when not needed to close the window openings. The large openings are covered on the outside with galvanized poultry netting. The floor may be any one of the several kinds previously mentioned; preference, however, is always given to well-laid cement floor.

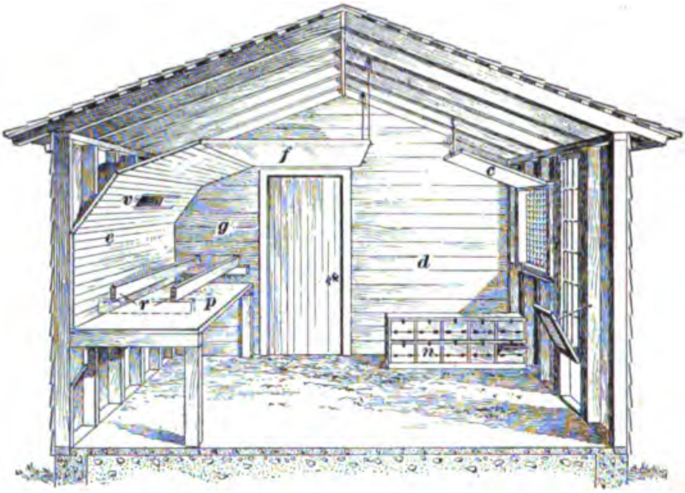


Fig. 23

37. The interior arrangement of this open-front house is shown in Fig. 23. The rooms are separated by the lumber partition *d*. The dropping-board is shown at *p*; and the roosts *r* are located 8 inches above it. In the rear and above the roosts is a shelter *e*, which forms a hood about the roost. The air circulates about the roosting place, behind this shelter and in between the studding. The interior of the roosting place is ventilated by the opening *v*. Both ends of the roosting place must be closed, as shown at the end *g*. The curtain *f* may be turned down over the front of the roosts to the level of the top of the roosts, leaving an open space between the lower edge of the curtain frame and the board *p*. When the curtain is down, the ventilator *v* in the top of the shelter should be open. The frame covered with cloth, as shown at *c*, is used to close the window opening, as previously described. The nest boxes *n* are placed 1 foot from the partition, so as to permit the hens to get on the nests from the rear.

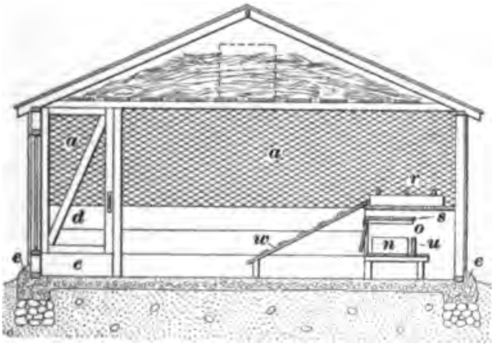


Fig. 24

38. House for General Use.—The house illustrated in Figs. 24 and 25 will meet the requirements of all localities where the winter temperature goes below 30° F., and with but few changes it will prove satisfactory for the warmest localities. The house shown is 18 feet wide and can, if desired, be made from 40 to 200 or more feet long, in multiples of 40 feet. The individual, or single, room, as shown in Fig. 25, is 18 feet wide and 20 feet long, giving 360 square feet of floor space. If 4 square feet is allowed to each hen, the room will house ninety hens. The roosting poles *r*, Fig. 24, each 20 feet long, furnish an 8-inch space for each hen when roosting. The roosts are reached by means of a walk *w*. The nest boxes *n*, 18 inches square at the base and 9 inches high, are pushed into the shelter made for them below the roosts. Below this shelter are open slats, which are made either of iron pipe or of 2″×3″ strips of wood. The rear of the shelter extends beyond the nests. The upright piece *u* in the rear of the nest is 9 inches high, leaving an open space *o* of the same height for the hens to pass through on the way to the nests. The movable shelter board *s* is 24 inches wide and rests upon cleats at each end. By such an arrangement, an enclosure into which the hens must go from the rear to the nests is formed about the nest. This kind of a hidden nest avoids the danger of egg eating by the hens. The eggs are gathered from the nests through hinged doors located in front.

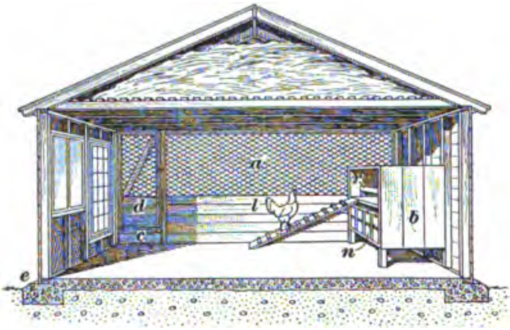


Fig. 25

39. A sheltered roosting place for winter use, which can be either permanent or movable, is built against the rear wall, as shown at *b*, Fig. 25. If it is to be movable, it should consist of sections which are made up of the back, two ends, and the overhead cover. In winter, these parts are set in place around the nests and the dropping-board. During the greater part of the year, when not in use, they may be stored in the loft overhead. If the structure is to be permanent, coops for extra male birds, or for broody hens and male birds, should be placed on top of the shelter *b*. During very cold nights muslin curtains should be hung over the front of the shelter. Such curtains will seldom be needed, however, for when the roosts are filled with hens, it will be, except during the most severe weather, quite warm enough. The floor of the loft is covered with dressed barn boards, a 6-inch space being left between them. This loft is filled with clean straw. The straw absorbs dampness from the interior, and also helps to keep the house warm. The circulation of air through the doors on both ends will keep the straw dry. For this reason, these doors are opened when the days are fine. When filled with straw, the loft will have a warming influence over the temperature inside the house during the winter and a cooling influence in summer. Thus, it is seen that this overhead loft is valuable beyond the extra cost of building. By omitting a hall in this building, 80 square feet that would otherwise be practically lost space for housing capacity is added to each section. This 80 square feet of space will house twenty hens, and by using the space for housing capacity, the per-capita cost of the house is lessened.

40. The front of the house under consideration has two long, narrow windows, the frames of which extend from a foot above the floor to within the same distance from the ceiling. One of these windows is placed at the extreme right and the other at the extreme left of each 20-foot room. Between the windows, and at a height of 3 feet above the floor, there are two openings. Each opening is 3 feet square and is closed on the inside with cotton cloth stretched tight upon frames. These frames are hinged at the top so that they can be turned up, or opened, and fastened against the ceiling or roof when not in use for controlling ventilation.

The lower 3 feet of the partition between the sections is made of lumber, as shown at *l*, Fig. 25, while the remainder is made of galvanized poultry netting as shown at *a*. The door *d* in the partition swings 1 foot above the floor, and beneath this door is a 12-inch baseboard *c*. The roosts *r* are made of 2″×3″ lumber, the 2-inch side being rounded and placed uppermost. Such long roosts should be supported at each end and in the middle. The floor is made of cement, and a cement wall 6 inches high extends all around outside of the building, so as to keep dampness away from the floor. This wall is also 6 inches wide on top and slants away from the floor, as shown at *e*, Figs. 24 and 25. The siding and roofing may be of any material desired, provided the house is made air-tight at the ends and overhead, and the front is made according to the description just given.

A poultry house of this kind can be used to advantage on any farm where poultry is kept in large numbers. If reasonable attention is given to the care of the house and the fowls, it will be quite satisfactory. Considering the number of fowls that can be kept in such a house, the cost of the building per head is not excessive, nor is the cost in time and labor so great as it would be if the fowls were kept in smaller flocks.

41. The style of house just described may be easily changed to meet the requirements of the warmest climate. To do this, the loft overhead should be kept clear and open during the heated term, the shelters about the roosts removed, the roosting capacity and nest boxes increased so as to accommodate a larger number of fowls, and the front made open, as shown in the house for hot climates, which is described in *Poultry Houses*, Part 2. Frame doors covered with galvanized poultry netting should also be placed at each end of the house close to the front. The air will then be able to circulate through these doors and through the open front, while the loft above will serve to carry away the heat overhead.

A building of this kind has a housing capacity fully equal to any house that contains the same amount of floor space. Its principal advantage in a warm climate is the overhead air space, which serves to protect the fowls from the heat of the sun during the day and to carry away the overhead heat at night.

COLD-WEATHER HOUSES

DOUBLE AND APARTMENT HOUSES

42. Double House.—The **double house** shown in Fig. 26 is intended for sheltering a large number of hens in a very cold climate. The floor plan is shown in Fig. 27. The illustrations show fully the construction of such a building. In reality it is nothing more than a large-sized, straight-front, slanting-roof building to which is attached a lean-to front that simply serves as a warm enclosure or a scratching shed. The main building is 16 feet wide and 24 feet long, and the lean-to, or shed, is 8 feet wide and 24 feet long. At the front of the main building is located the roosting place *r* for the hens, and on the opposite side are placed the nest boxes *n*, the feed-hoppers, the water fountain, and other appliances. In the roof of the lean-to, or enclosed scratching house, are placed glass windows, which admit plenty of light. No matter how warm the scratching shed may become, it has very little influence on the temperature of the main building. The main building receives light through the small windows in the front and those at the ends, as is shown in the figure.

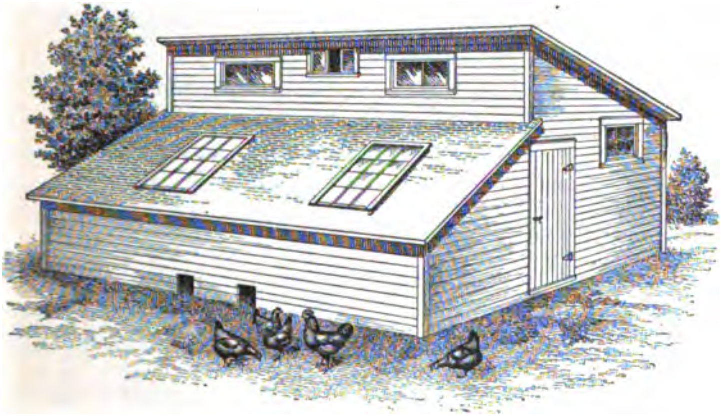


FIG. 26

The height of the main building is 9 feet in front and 6 feet in the rear, while that of the lean-to is 6 feet where it joins the front of the main building, and only 3 feet at the lower side. The main building has double siding on the rear and ends, with tar paper laid in between. The four walls and the overhead part of the main building inside are lined with flooring, the tongues and grooves of which are painted. The roof construction is the same as that described in Art. **23.**

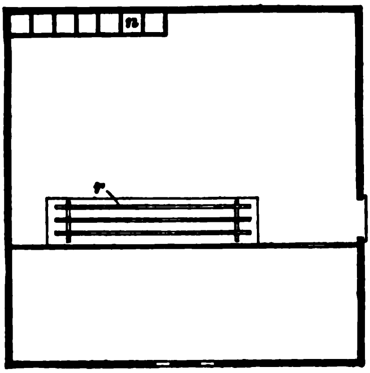


Fig. 27

43. Apartment House.—A poultry house having one straight hall that extends all the way along in the rear is called an **apartment house.** Such houses are intended for several flocks of fowls that are kept separate for breeding purposes. In Fig. 28 is shown an exterior view of an apartment house that has six apartments, or pens, and a continuous passageway, the latter being located at the rear. A construction of this kind permits the attendant to pass through the hallway in the rear of the pens with a small push cart or wheelbarrow to clean the dropping-board; it is also convenient for feeding and watering the poultry, and for gathering the eggs. The floor plan of this house

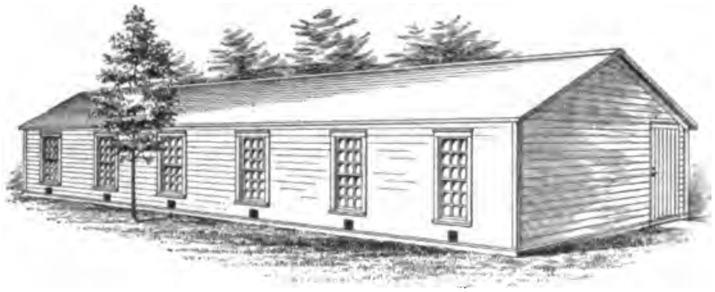


Fig. 28

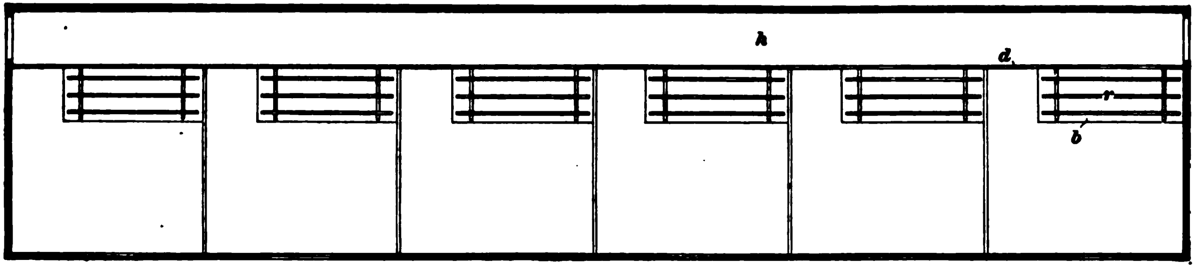


FIG. 29

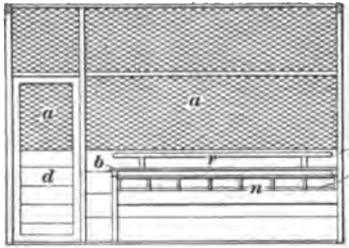


FIG. 30

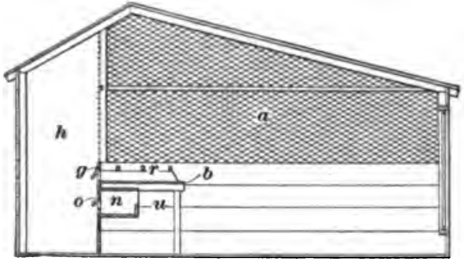


FIG. 31

is shown in Fig. 29, the long hall that extends the entire length of the building being shown at *h*. A roosting place *r* is located in the right-hand corner of each apartment, and the nests are located beneath the roosts.

A section of the hall partition is shown in Fig. 30. This partition and also the division partition shown in Fig. 31 are made of boards and galvanized poultry netting, the board part being 3 feet high and the netting extending to the roof line, as shown at *a*. Each apartment has a small doorway *d* that opens into the main hall. The door is hung on self-closing hinges, which permit it to open both ways.

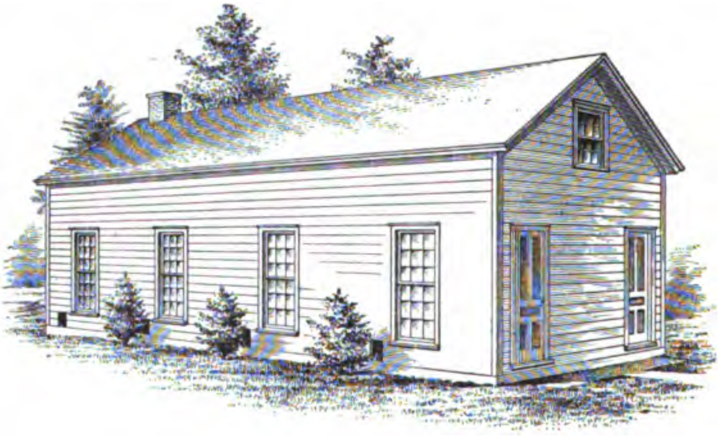


Fig. 32

The dropping-boards *b* are placed in the rear of the roosts *r*, next to the hall, and have a door *g* that is hinged at the top and opens into the hall. This arrangement permits the droppings to be scraped from the dropping-board into the hall. The nests *n* are placed beneath the dropping-board. These nest boxes have doors, or openings, *o* that open out into the hall, and the eggs are gathered through them. The doors of the nest boxes are hung from above the center line of nests and are about one-third as wide as the nest boxes are deep. The nest boxes are raised 18 inches above the ground, and are from 12 to 14 inches wide, 14 inches long, and 12 inches deep for small fowls, 14 inches deep for Asiatics. The hens enter the nests through the opening *u* under the dropping-board.

The windows in front of this house are closed with glass, as shown in Fig. 28, but if preferred, they may be made like those shown in Figs. 22 and 23. The house shown in Fig. 28 is 16 feet wide and 74 feet long. The hall, rear wall, and partition occupy 4 feet, leaving a depth of 12 feet for the pens, each of which is 12 feet square. The house is sufficiently large to accommodate one hundred and fifty hens during the winter, but when used as a breeding house during the spring and summer, not more than twelve hens and one male bird should be kept in each apartment, or pen.

44. House for Cold Climate.—The **four-room connected-apartment house** shown in Fig. 32 is 16 feet wide and 40 feet long. It is a complete structure for all purposes for which poultry buildings are used. The hallway, shown in Figs. 33 and 34, leads to a stairway in the rear, while this stairway leads to the second floor, where many convenient appliances may be kept. The first floor of this house is made of boards laid upon cement, the concrete being filled in between 2″×4″ sills laid across the width of the building. In constructing a floor of this kind, the concrete, when perfectly dry, should be coated on top with boiled tar or asphalt, and the flooring then laid tight and close and nailed fast to the cross-sills. All the windows are closed with double sashes, and the doorway at the left with a double door.

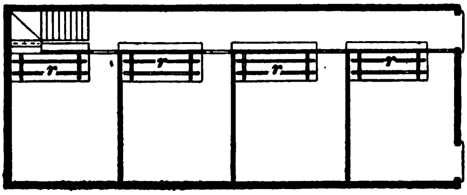


FIG. 33

The ground-floor plan, Fig. 33, shows four pens, each of which is 10 feet wide and 12 feet deep. This size of pen is large enough for thirty hens during the winter months, but the number of fowls kept in each pen during the breeding season should never exceed fifteen. The partitions between the pens and the hall are made of tongued-and-grooved flooring, while the interior of each pen is finished in the front, at the ends, and overhead with dressed flooring. The outside wall at the north has tar paper beneath the siding and is boarded up on the inside with flooring. The dropping-boards and roosts *r* are located next to the hall partition, and have nest boxes beneath, the nests extending into the hallways and having an opening on top covered with lids, which may be opened to gather the eggs. There is an opening above the nest-box openings through which the dropping-board can be cleaned in the same manner as mentioned in the description of the apartment house. Small openings through the boards on the inside of the hall wall are made near the floor, so that cold air may pass into the spaces between the studding and into the room overhead, thus aiding in the ventilation of the house.

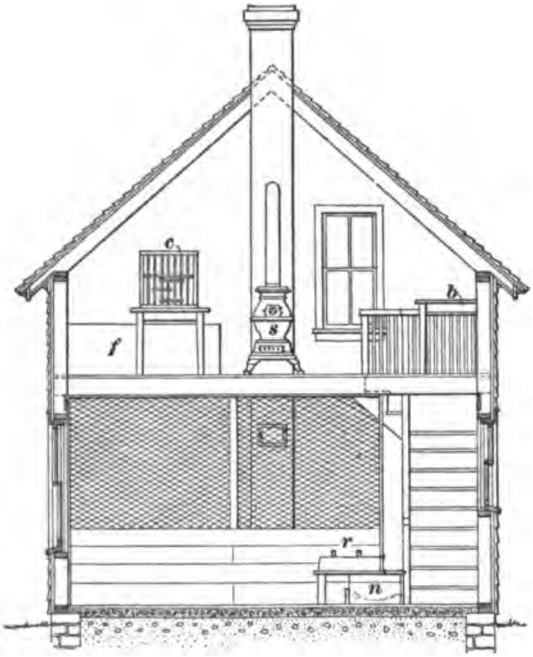


Fig. 34

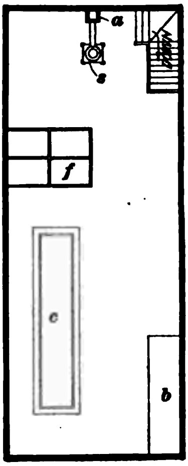


Fig. 35

45. The sectional elevation of the building for cold climates is shown in Fig. 34. The roosts and nest boxes on the first floor are plainly shown, as is also the stairway leading to the second floor. On the second floor are shown a small laundry stove *s*, exhibition coops *c*, and the end of a work bench *b*. The plan of the second floor, Fig. 35, shows the chimney *a* in the rear, the stove *s*, the work bench *b*, and the feed-box *f*. This box is divided into four bins for storing different kinds of grain.

A building of this kind should have an opening into the chimney from the rear of the apartment below, and this opening should be closed with an iron frame and door, through which ventilation can be had at times. The iron door should be opened only when ventilation other than that coming through the wall is needed.

HOUSES FOR LEGHORNS

46. Winter House.—One of the problems to be considered when planning poultry houses is the building of a house that will protect the combs and wattles of Leghorns from the injurious effects of severe cold. Nothing is more certain to decrease the winter egg yield of hens than the frosting of their wattles and combs. For this reason, if for no other, it is desirable to have the best possible protection from frost in houses intended for laying hens. The interior of a house intended for this purpose must be free from dampness or frosty conditions, and must be so constructed that sudden changes of temperature can be guarded against. The open-front house is usually dry, but its temperature is nearly as cold as that outdoors. One of the desirable features of a poultry house is comfortable winter quarters that are free from dampness.

The house illustrated in Fig. 36 is really a double building, or a house within a house. When properly built, or, perhaps, successfully built is a better term, the interior of such a house is dry and comfortable; but when not successfully built, it is nearly as cold and damp as an ice box. This style house in particular should face the south, so as to get all the advantages of sunshine during the winter. The outside of the building shown in the figure is covered with building paper and siding, and the entire inside is lined with jointed flooring that is tightly put together. The window frames have a double sash and glass, with as much space as possible between the glass. This is done by making the sash heavier and rabbeting them. The openings *o* between the uprights in front open into the space between the outer roof and the overhead covering of the interior apartment, while the hallway *b* extends to the roof. The result is an open-air chamber about the pens, which are enclosed under a roof *c*. There is an open hall at the rear that can be used for many purposes. The roosts *r* and nest boxes *n* are placed next to the hall partition, the nest boxes being above the roosts. The floor boards of the nests serve as a roof, or hood, for the roosts, one end of which rests against the solid portion of the partition. Since the roosts are sheltered overhead and at one end, it is unnecessary to enclose the front or other end. If the overhead, back, one end, and floor of the roost are almost air-tight, there is no need of other protection for the roosting place of this building.

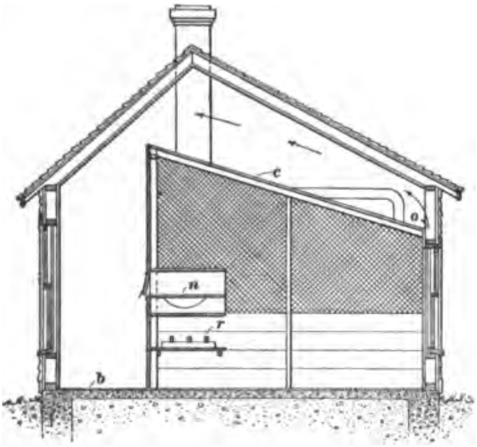


FIG. 36

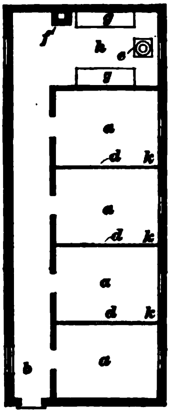


FIG. 37

There is no opening leading into the hall from the dropping-board, which must be cleaned from within. There is, however, an opening into the hall from the nest boxes.

47. The floor plan of the winter house is shown in Fig. 37. The interior, which is 50 feet in length, is divided into four pens *a*, each 10 feet wide and 12 feet long, and at the end of the building is a room *h* that opens into the hall *b*. The three partitions *d* are like those shown in Fig. 31, except that the base is made 4 feet high so as to enclose the roosts. The nests are placed above the roosts, as shown in Fig. 36. Room *h* is equipped with a small laundry stove *e*, and two feed-boxes *g*. The latter have flat tops and serve both as feed-bins and as tables.

The floor of the entire house is made of cement. The chimney is made of brick and has a stove hole near the roof and an opening close to the floor. This opening is closed with an iron frame and door. The chimney may be cleaned through this opening, and ventilation for the interior of the building may be had when needed through the opening into the chimney *f* to the outside. The free circulation of dry air about the walls of the inner building should prevent cold and dampness from gathering in the pens. The openings between the side-wall studding and leading into the open space overhead draw the cold, damp air from between the walls. Small round holes are made through the inner front wall *k* from the pens into the wall space. These openings are located about 18 inches above the floor and between the front windows. There will be enough ventilation through these holes to insure sanitary conditions within the pens during cold weather. The most satisfactory evidence of a successful house of this kind is found when, during zero weather, the side walls are free from dampness and frost and the straw litter upon the floor is dry and crisp.

48. Necessity for Warm Houses.—The necessity for warm houses does not occur except in localities that have long continued, severe cold weather. Where there are months of such weather, fowls must either be protected from the injurious influence of cold or be allowed to rough it and have their combs and wattles frozen. During very cold weather when fowls drink and their wattles become wet, the cold freezes them into a swollen sore mass, which seldom if ever heals before warm spring weather arrives. Warm poultry houses correct such conditions and protect the hens from the rigors of winter and keep them laying during the coldest weather.

The open-front, or curtain-front, house is largely used in some localities for the protection of laying hens. In many localities, the fowls winter remarkably well in such houses, while in other localities, they fare badly. Again, the laying hen will do remarkably well in some localities in the warm winter house, and fail under the same conditions in others. Wherever there is a dry interior to the house, either plan proves satisfactory, but where dampness prevails, there is certain to be more or less trouble during the winter months. These facts emphasize the vast importance of having a dry interior in poultry houses. The value of a dry interior cannot be overestimated.

HILLSIDE AND CANOPIED HOUSES

49. Hillside House.—To build upon the hillside may be either a matter of preference or one of compulsion. Such sites are frequently selected because they can be used more profitably for poultry runs than for any other purpose of farming. When such a site is selected, the house should be located upon the side of the hill that affords the best winter exposure to the sun, using a foundation like that shown in Fig. 7. The excavation is made 6 or 7 feet below the surface, or to the depth demanded by the grade of the hill. Cement or stone walls at both ends and the rear should be laid to the required height for the foundation of the building. The center of the house should be supported in front with an upright timber not less than 4 inches square. A cement floor laid in the basement is desirable, because it will prevent the formation of dampness arising from rain and melting snow. If stone walls are used, they should be laid with cement, so as to keep out the dampness. The entrance or exit for the fowls from the building into the basement and range is through a hole in the floor above and leads down an incline into the basement. The front of the basement may be left open during the greater portion of the year, but it should be kept closed during the winter months by means of movable fronts of muslin, glass, or boards made in sections for easy handling and storing.

50. Poultry cannot be housed successfully in basements or cellars under the ground, because such places are damp, and, for this reason, do not make healthful abodes or roosting places. To avoid these drawbacks, houses are built upon a hillside with their basement walls above the ground. Fig. 7 shows the elevation and the arrangement of floors suitable for a hillside house. Instead of an end entrance, as shown in Fig. 28, the doorway leading into this house, Fig. 7, is located near the center of the rear wall; otherwise, the same elevation and interior may be used as is shown in several plans described. The windows are next to the slope of the hill. This part is called the front, and the rear is where the hall is placed. The stairway for the attendant is from the hall into the basement, and the incline *w*, Fig. 7, for the fowls leads from the roosting room, or pen, into the basement. The incline consists of a slanting board upon which strips are nailed. The fowls can easily pass up and down such an incline. When the entire building is a single pen for more than thirty fowls, two of these inclines for the fowls will be necessary; when there are fewer than this number, one will do. If the house is divided into separate pens, there must be an incline for each pen. The floor of the house is best made of double-laid flooring, between which should be laid tar paper so as to shut out the cold and the red mites. Almost any style of house can be built upon the hillside wall if these special precautions are observed. The basement furnishes a shelter or a scratching place for the poultry during all seasons, and if enclosed with windows during the winter, it provides a warm shelter and sun bath for the fowls.

51. Canopied House.—A **canopied house** can be used for the double purpose of housing a few hens on a lawn and of storing garden tools that are used about the yard. The house should be so attractively built as to become an ornament as well as the abode of highly valued fowls, pheasants, or other birds. It may be of the most elaborate design and profusely ornamented, or it may be as plain and simple as a house can be built. Such a house may be constructed in the most exclusive localities, and a few hens may be confined therein (with no male birds) without their becoming objectionable. It is ideal as a house for Bantams.

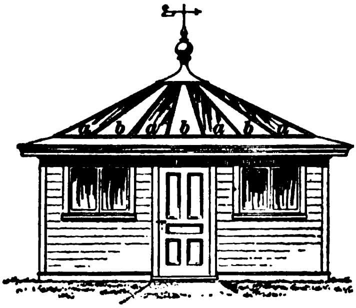


Fig. 38

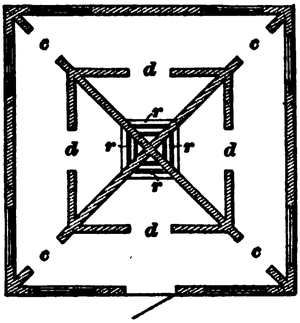


Fig. 39

The roof of the canopied house shown in Fig. 38 consists of an iron frame the lower part of which is covered with corrugated galvanized iron, the top being solid, and capped with a weather vane. Half of the openings, which extend from the solid part of the frame to the upper edge of the corrugated iron, are closed with wire glass *a* of proper size and thickness to fill them. The alternate spaces *b* are filled with boards that have been dipped in creosote stain. The glass in the roof is of sufficient length to admit light into the pens and the enclosed runways. The roof overhangs the walls sufficiently to shed the water away from them. The lowest edge of the roof should not be less than 7 feet above the floor level. The house is built upon a cement floor, which extends beyond the eaves of the roof and slopes from the roof line just enough to shed the water away from the house on all sides. The double windows on each side have sliding sashes that can be pushed either way. The fowls can easily be seen through these windows. The sashes are filled with glass for winter use, and are exchanged during the summer months for frames filled with galvanized-wire screens, the screen windows permitting free circulation of air during the warm weather. The windows should be kept closed continually, so as to prevent the fowls flying out.

52. A canopied house that is 16 feet square can be divided into four pens, with an enclosed runway, or hall, for each pen, as illustrated in Fig. 39. The roosts *r* with nest boxes beneath them are placed in the rear of every pen. Each pen has a door *d* leading to the hall, or runway, and each runway has a door *c* at the corner. All these doors are hung at least 6 inches from the floor upon self-closing hinges that swing both ways. The exterior is covered with beveled siding boards, and the interior, including both side walls, the partitions, and the overhead part, is lined with beveled-board ceiling, all of which is smoothly finished without cracks or crevices. The inside work is varnished, and the outside of the building is painted to match the other buildings upon the place. There may be small openings from each runway through which fowls may pass when they can have the liberty of the lawn or an enclosure. To add to the retirement of such a house, an enclosure of latticework may be built around it, and ivy, vines, ramblers, or other climbing plants grown over the latticework. A few fowls can be kept within such an enclosure in a sanitary manner.

POULTRY HOUSES

(PART 2)

STATIONARY AND MOVABLE HOUSES

COLONY HOUSES

1. Development of Poultry Houses.—For many years prior to about the year 1900, all poultry houses that were built in the colder climates had close walls and tight-fitting windows of glass. No ventilation was provided. During winter weather, when closed at night, these houses were very cold and damp. Houses with small glass windows failed of their purpose, as did those with the entire front and roof of glass and sash. Often the house with the glass front had summer heat inside when the sun shone on it during a cold winter day, while the same house would have zero temperature at midnight. The results obtained from using such houses were not satisfactory, and the failure to produce an average egg yield from the hens prompted diligent research for better plans for housing poultry. Of the many new kinds of houses tested none seemed equal to those with the open, or cloth, fronts; after it had been demonstrated that the open shed would provide sufficient shelter for the fowls in a mild climate, this was accepted as a guarantee that the same kind of a shelter would answer for all localities. Climatic conditions, however, were given little consideration in these tests, and it is believed now that the effects of severe climates must be considered before satisfactory results with open houses can be obtained in all localities.

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2. Stationary Colony House.—The term *colony house* is one frequently applied to any detached building for separate groups of poultry. A colony house proper, however, is one that is not only detached but is placed by itself in an open lot or field where the fowl have at least partial freedom and are separate from other groups.

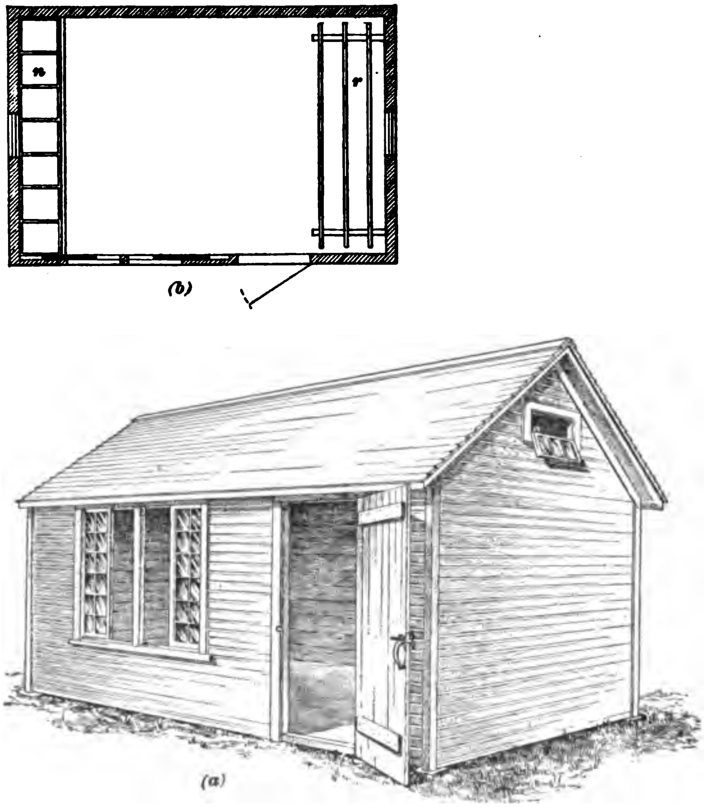


Fig. 1

A style of house used in egg-producing districts where the climate is generally mild and where there are but few weeks of winter weather, is illustrated in Fig. 1, view (*a*) showing the completed house and view (*b*) the floor plan. This kind of house can be used in any locality where the temperature is mild enough for hens to run outside during the winter. The house shown is 8 feet wide, 12 feet long, 6 feet high to the eaves, and 9 feet high in the center. Such a house must be strongly framed and the frame covered with siding or barn boards that have been dressed on one side. The roof is of shingles; the front has two windows, the sashes of which slide to the right and to the left, and may be filled with window glass or covered with muslin. The entrance door, which is in the southeast corner of the building, is 2 feet 6 inches wide and made of the same kind of lumber used for siding. At each end of the building is a small ventilator placed close to the peak of the roof. The building is set on four corner stones, with no other foundation beneath the sills. The bottom of the floor is made of large stones, on top of which are smaller stones and broken brick, and finally very coarse gravel, all tamped solid and filled level to the top of the sills with clay just moist enough to pack well and become hard. Three lengths of roosting poles *r* are placed across the width of the building behind the door in the east end of the building, and the nest boxes *n* are placed across the west end.

This house will accommodate about twenty-five hens. A house for from fifty to sixty hens should be 12 feet wide, 20 feet long, 7 feet high to the eaves, and 10 feet high to the peak of the roof.

Dropping-boards are not generally used in stationary houses of this kind, the floor beneath the roosts being covered with loose earth or sand. Colony houses of this kind are best suited to farms where the fowls run at large during the day.

3. Movable Colony House.—All kinds and styles of colony houses that are not too heavy, can be made movable by putting them on runner foundations. Heavy planks 2 inches thick and 6 to 8 inches wide are best for this purpose. The planks are generally laid flat and are rounded or beveled at both ends like the front end of sled runners. They are fastened together at both ends and in the center, and the house is built on them. Houses of this kind are used for brooder houses, for young chicks, for colony houses, for maturing pullets, and for laying hens on the range. When it is desirable to move these houses, they can easily be drawn from one location to another. Whenever there are a large number of fowls housed in colonies, the house should always be built on runners so that the entire plant can be moved; for it is often desirable on account of sanitary or other reasons, to transfer the hen houses from one place to another. If the houses are movable colony houses, this can be done at will and with little expense and trouble.

4. **Movable Laying House.**—Movable houses may be made attractive like the one shown in Fig. 2, and if they are built on runners they can be moved easily and without damage. Such a house is often used on the lawn or in the orchard of a country place, and its presence is not objectionable, provided the finish is equal to the surroundings. Inside of the house and 3 feet from the front of it is a partition, the lower 3 feet of which is made of boards while the upper part which extends to the ceiling, is made of 2-inch mesh galvanized poultry netting. The board part of the partition prevents drafts of air from blowing against the fowls on the roost at night, and the netting prevents them from flying into the feed room in front. The dropping-board and the roosts are in the rear, close to the end of the house. The dropping-board is hinged against 2″×4″ uprights, leaving an open space between the edge of the board and the inside of the siding; in front, the board is supported on legs hinged close to the front corners, or it may be held up by two strong wire

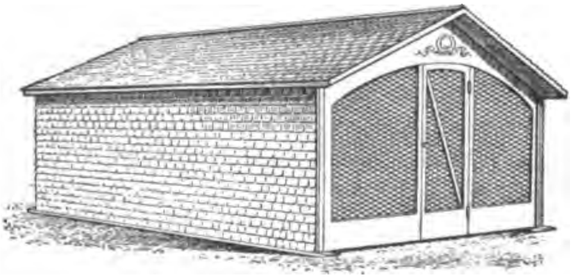
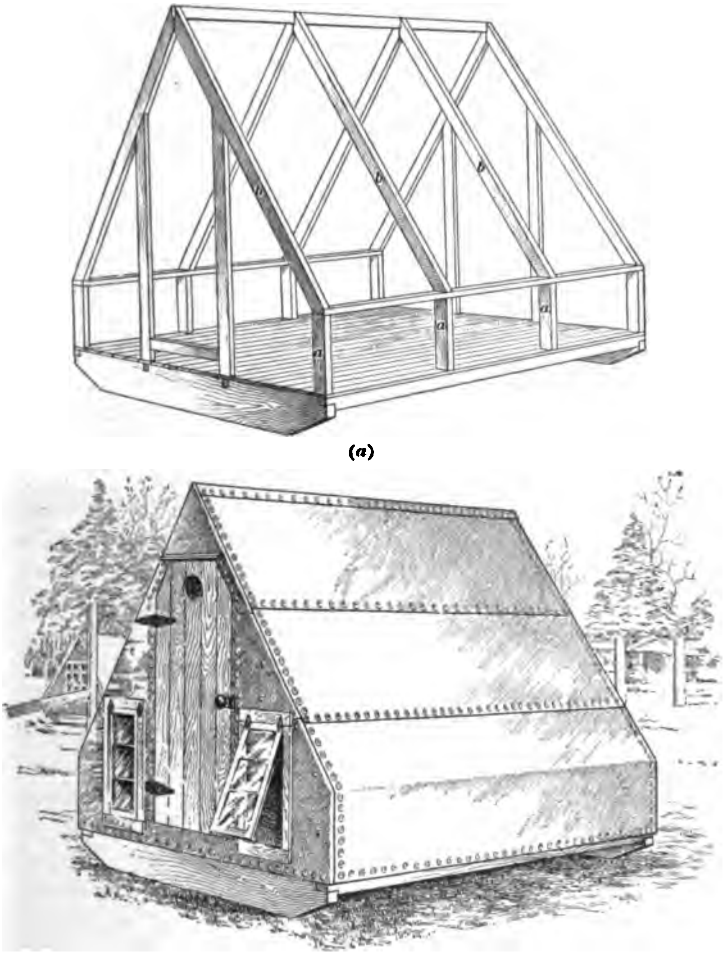


FIG. 2

hangers fastened to staples in the beam overhead and in the edge of the dropping-board. The roost poles are movable.



(a)

(b)

FIG. 3

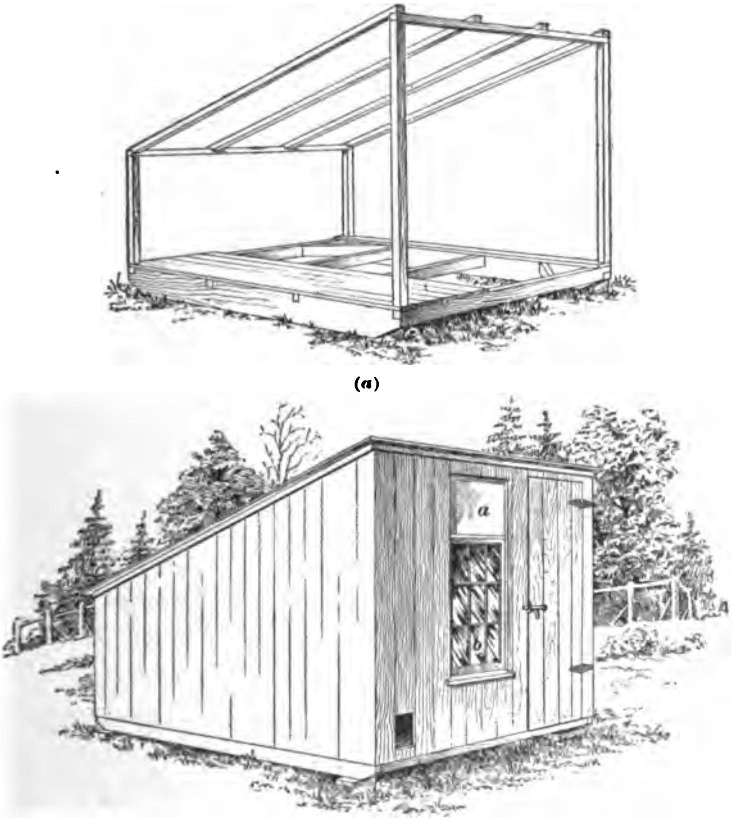
The nest boxes are placed inside of and against the partition. Feed-bins for the grain supply are in the front of the building and on both sides of the door; they should be rat-proof.

The roof, rear end, and two sides of the building are covered with stained shingles and the front is finished in cottage fashion. The house may be made to conform to any style of architecture used in other buildings on the place, and the door may be in the rear or in the side of the building.

A tight board floor may be laid in such a building to prevent the ground beneath from being dug up by the hens. As a rule, however, movable colony houses that are built or set low to the ground do not have board floors unless the buildings are to go on a well-kept lawn or some other place where it might be undesirable to have holes dug into the ground. Buildings set on high runners must have board floors.

5. House on Runners.—In Fig. 3 is shown an **A**-shaped colony house, built on runners made of oak planks 2 inches thick and 12 inches wide, set on edge. If pine or hemlock runners are used, they should be 2½ inches thick. Runners must be strongly put together, as the entire weight of the house rests on them, and there is also considerable strain on them in moving the house from place to place. The base frame *a* is made of 2″×4″ scantling, and is from 12 to 24 inches high above the floor, according to the required height of the entire building. Above the base frame is the apex frame *b*, which is made of 2″×4″ scantling and is built to an inside height of 5 feet above the base frame. The floor of the house, which is 8 feet square, is of tongued-and-grooved boards, strongly fastened to the runners. The frame is sheathed with the cheapest kind of lumber, which is dressed on one side and laid with the smooth side out. The sheathing is covered with tar paper or three-ply roofing felt. The frame can be made so that the entire house can be covered with heavy roofing felt or paper, the same as the cheaply built house to be described later. To do this, the uprights and cross-pieces should be set to correspond with the width of the roofing paper used. The interior of the house is furnished as described later on for the apex house, and there are dropping-boards, roosts, and nest boxes on both sides of the house when it is used for laying hens.

6. Light-Weight House.—A satisfactory **light-weight house** that can be quickly and cheaply built and that may be made either movable or stationary, is illustrated in Fig. 4, in which view (*a*) shows the framework, and view (*b*) the finished house. The house is 8 feet square and is built on runners. The timbers of which the runners are made are the heaviest used in the construction, being 2½ inches thick, 8 inches wide, and 8 feet long. The structure is 6 feet high in front and 3 feet high in the rear, inside measurements.



(*a*)

(*b*)

FIG. 4

If desired, the house may be built 8 feet wide and 10 or 12 feet long; when it is longer than 8 feet, the floor joists are laid across the narrow way and the runners set lengthwise. The 2″×4″ joists are let into the runners flush with the top of the foundation. The door and the window in front are the only openings. The upper part of the window is closed with a muslin covered frame *a* and the lower part with sash and glass *b*. This house is light in weight and can be moved about and located wherever there is the best ranging for the fowls. It is a style that is best adapted for young stock growing on the range, for immature pullets, and for market stock. During summer, the wooden door should be exchanged for one covered with galvanized poultry netting and the upper part of the window should also be covered with the same material, the sash and glass remaining in place the entire time.

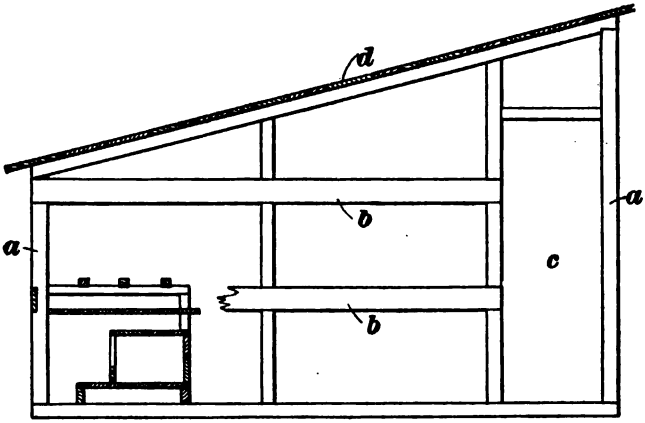


FIG. 5

7. Inexpensive House.—An inexpensive poultry house can be made by covering a framework with heavy roofing paper or flint-coated felt. Any style or kind of a poultry house can be built in this way, provided the framework conforms to the width of the paper, so that all joints will come on the runners or sills, and can be made tight. Fig. 5 illustrates the framing of such a house. The outside frame *a* is made of 2″×4″ scantling, and the cross-strips *b* are of 1″×6″ pieces let into the scantling so that the outside surface of all will be even and smooth. The frame for the door *c* is fitted and hung to the door frame with flat or strap hinges. All the necessary openings must be provided for in the framework.

After the framework has been completed and before the roof is put on, the entire outside, including spaces to be occupied by doors or windows or other openings, is covered with heavy roofing felt. Fig. 6 shows the paper on the framework after the doors and windows are in place. The covering is turned over on top of the rafters all around the building and fastened all around the framework and doors and openings by roofing nails with tin caps. All joints are laid close together on the rafters, or 6-inch runners, and are joined in place by cement as well as fastened with nails and tins. The felt must be nailed tight to the frame of the door and also to the door frame. Especial care must be taken to make the covering secure around every place where there will be an opening. When all the framing has been covered, the felt or paper over the openings is cut out and the paper is also cut around the door so that it will swing free. The

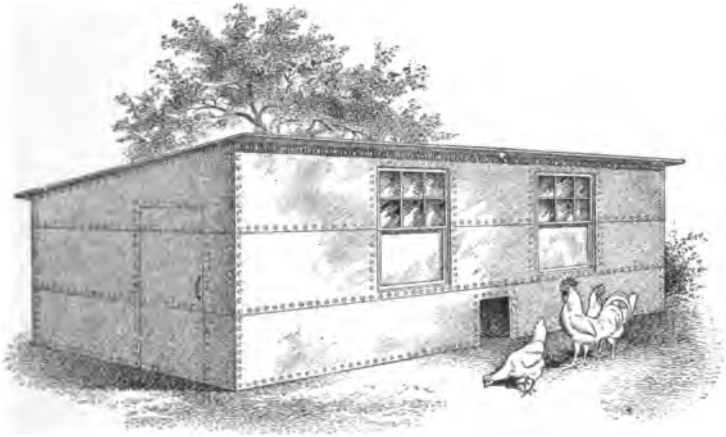


Fig. 6

roof is then carefully laid on the rafters and is covered with the same kind of strong paper that was used for covering the sides.

The lasting qualities of a house like this depend largely on the quality of material used and the manner in which it is put together. If the lumber is green, it will shrink in drying and split or tear the paper; if the paper is poor in quality, it will last only a short time; and if badly laid, the wind and rain will loosen it. When the roof is finished as it should be, its service can be greatly extended by tarring it once a year. This house can also be set on runners, the same as described for other houses. Substantial runners for a house of this kind would be made of 4″×4″ timbers. The objectionable feature of the low-set runners is that rats can be harbored in safety under the house when the floors are so close to the ground.

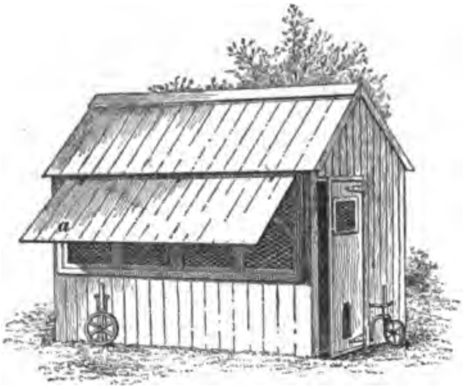


Fig. 7

8. House on Wheels.—Light-built, open-front houses on wheels are used in some localities. There are several kinds of these used, one of the most desirable of which is shown in Fig. 7. This house has three wheels, one on each side near the rear, and one in front. The one in front is a pivot wheel that turns in a socket, and all the wheels are raised and lowered with a lever. When the house is to be moved it

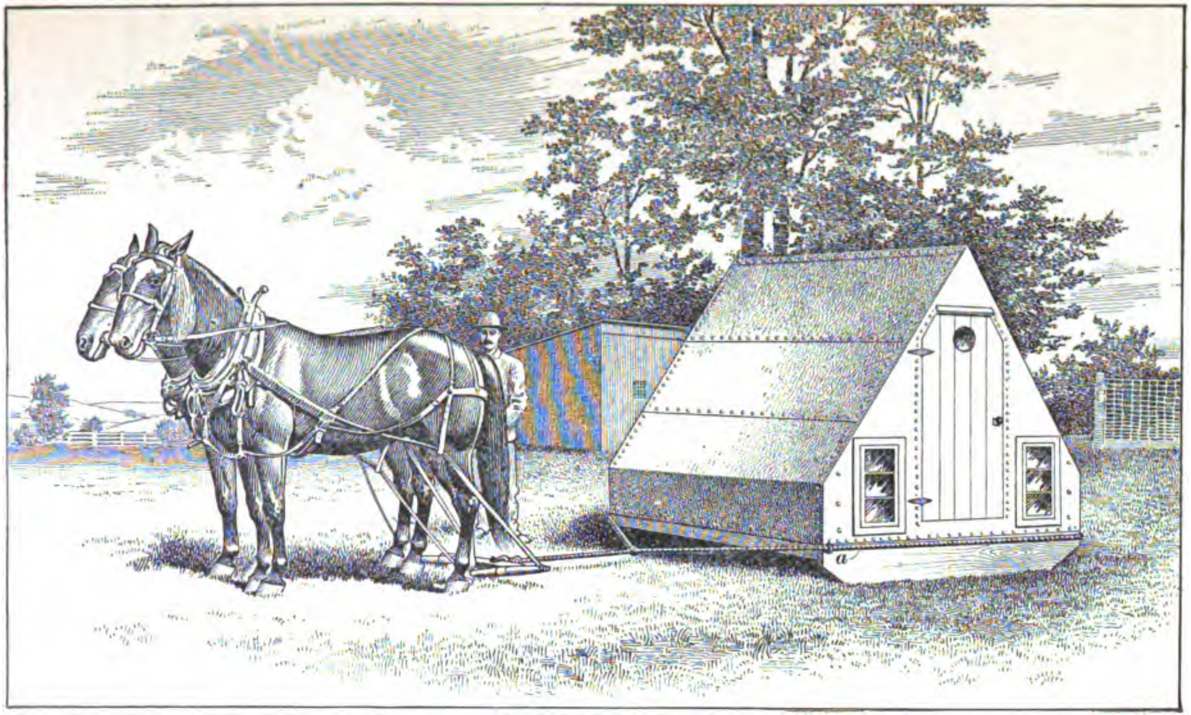


FIG. 8

is elevated on the wheels, hauled to the new location, and lowered to the ground. The upper half of one side of the house is arranged as a hinged door *a* that can be turned up as shown. When open, this door protects the interior of the house from rain and snow. A window for light and a small opening for the fowls to go through are in the front, or entrance, door. This small window opening is covered by sash and glass during cold weather, and with a screened frame during mild days. This kind of movable house is used for mother hens and their broods; also for small lots of laying hens kept near the house or on the lawn. A number of such houses, when placed under trees in an orchard, provides comfortable shelter for a large number of chicks. These same houses can be moved to the open range or to enclosed yards and used during the winter for laying hens.

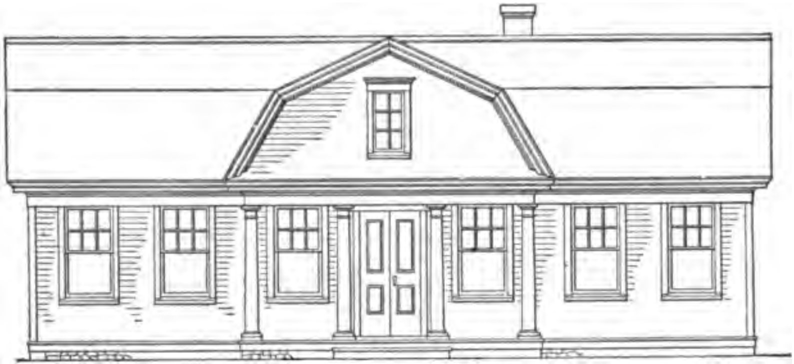
9. **Moving of Houses.**—When houses are to be moved, it is necessary to use some motive power that is equal to the task and that will not cause damage to the building from quick jerks and bad starts. A single horse can move some of the smaller houses, but several may be required to move the larger ones. Rings or hooks should be fastened to the runners or holes made through them to provide a strong hitch for the chains or ropes used in hauling. It is necessary that the hitch be substantial so that it will withstand the strain of starting. To assist in this, a strong rope can be wound around the house, resting low against the rear, and only high enough in front for the hitch of the team. The use of a rope in this way will insure the safe moving of the house. When the houses are moved, the team should be hitched as shown in Fig. 8, with the rope *a* bound round the runner close to the floor and brought together in front. Any colony house, provided it is not too heavy to stand the strain, can have runners and be moved about.

HOUSES FOR SPECIAL PURPOSES

HOUSES FOR POULTRY FARM

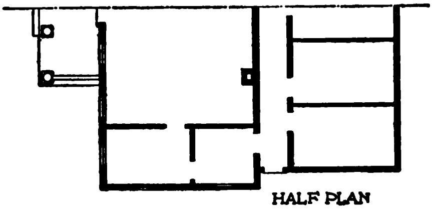
10. Headquarters.—On a large poultry farm it is often desirable to have a building for headquarters. A convenient arrangement for headquarters building and poultry house combined is shown in Fig. 9. In this illustration, view (*a*) shows the front elevation; view (*b*), a half plan; and view (*c*), the side elevation. The office is to the right of the front entrance and the reading room to the left. At the side of the office and in the front part of the building is a bathroom; and in the rear of the bathroom is a feed-room. The office, reading room, bathroom, and lavatory, are for the convenience of the employes on the farm. The second floor is divided into two rooms which are used as emergency sleeping rooms. The bathroom and the bath tub are used for washing and preparing the fowls for exhibition; and the reading room serves as a drying room for the fowls after they are washed. The house for headquarters is best heated with hot water; when there are greenhouses on the same farm, the poultry house can be heated from the same system that warms the glass houses. There should also be a stove in the reading room to make additional heat for drying the fowls quickly after they are washed. When poultry houses are used for rearing fowls for exhibition purposes, hot-water pipes can be run the full length of the hall between the two buildings to warm the poultry house and to keep it dry in very cold weather.

11. Poultry House.—The poultry house is at the rear of the office building and attached to it. Between these two buildings and under the same roof is a hall 4 feet wide. This hall, which has a door at each end, is used in caring for the fowls. The floor in the hallway and poultry house is made of narrow board flooring laid on cement and concrete. An interior view of the house, illustrating the hall partition, is shown in Fig. 10, and in Fig. 11 are shown the details of construction. The base of the hall partition is a wooden sill *u*



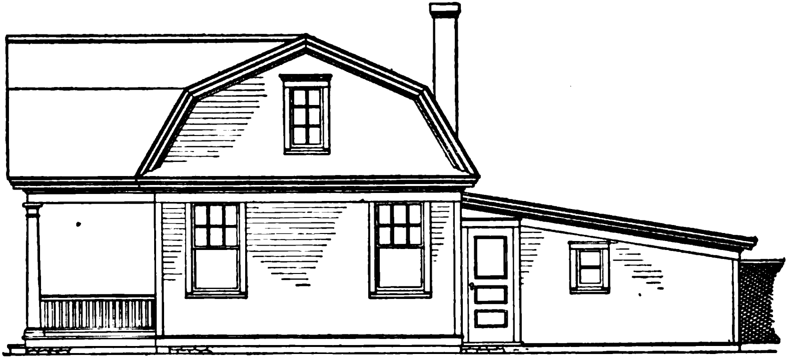
FRONT ELEVATION

(a)



HALF PLAN

(b)



SIDE ELEVATION

(c)

Fig. 9

6 inches wide laid the entire length of the hall. The lower part of the partition is made of slats *s* 2 inches wide and

18 inches high, set with a space of 2½ inches between them; above the slats it is made of close-fitting boards *b* to a height of 2 feet above the top of the roost poles; and the upper

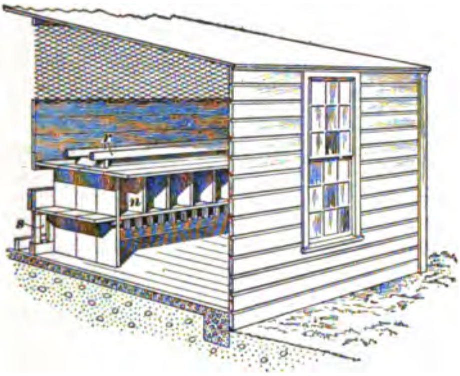


Fig. 10

part, extending to the roof, is of galvanized poultry netting *a*. Along the length of the hall is laid a trough *t* in which wet and dry mash food is placed; the food is reached by the fowls through the slat part of the partition. In a recess in the slat work at one end of each division of the room is a water pan *w*

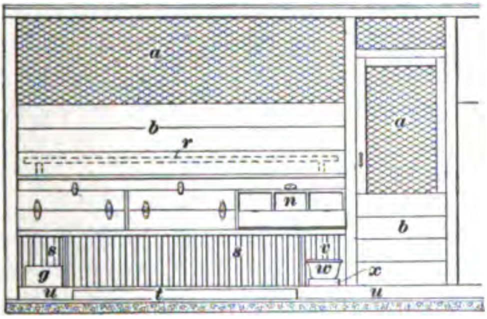


Fig. 11

set in a round enclosure *v* on a low platform *x*, so as to bring the top of the water vessel about 9 inches above the floor; at the other end of each division is a grit box, or hopper, *g*.

The nest boxes *n* are placed along the hall partition, and above these are placed the dropping-board and roosts *r*. The roosts, dropping-boards, troughs, and nests are movable. The room is divided into pens by partitions of boards and poultry netting, the board parts being built to a height of 3 feet above the floor level and again to a height of 3 feet above the level of the roosts, to prevent the males in adjoining pens from fighting while on the floor or on the roosts.

The nest boxes are 12 inches wide, 12 inches deep, and 16 inches long. They are built in sections, each one of which has a hinged door, and the sections fit into a shelf beneath the dropping-board, leaving an open space of 4 inches between the top of the nest box and the bottom of the dropping-board. If the nest boxes are supported by three iron rods, or by three lengths of iron pipe, and are movable, mites are not likely to be troublesome. The dropping-board is placed above the nest boxes, and above this are the roost poles. If but one length of roost pole is needed, the dropping-board should be 24 inches wide; if two lengths are used, it should be 30 inches wide; and if three lengths are used, it should be 36 inches wide. In placing the three roost poles, there should be 9 inches of space between the poles, and also between the wall and the rear pole. When placed in this way over a dropping-board that is 36 inches wide, there is a space of 9 inches between the poles, and 9 inches of board, front and rear, beneath the poles. If the dropping-board is wider than 36 inches, more space can be allowed between the poles.

HOUSES FOR LIMITED SPACE

12. Town-Lot House.—In order to keep poultry on a small town lot without annoyance and to have the fowls under control without destroying the appearance of the lawn and yards, it is necessary that attention be given to the general arrangement of the poultry house and yards, so as not to take up all the space. A 50-foot lot may be arranged as illustrated in Fig. 12, which shows a walk at the rear of the house through the middle of the lot. The poultry house is located at one side of the walk, preferably to the north or to the west. If the lot lies east and west, the poultry house should be located on the north side, facing the south; if the lot lies north and south, it should be located on the west line facing the east, so that the greatest amount of sunlight will reach the house during the winter.

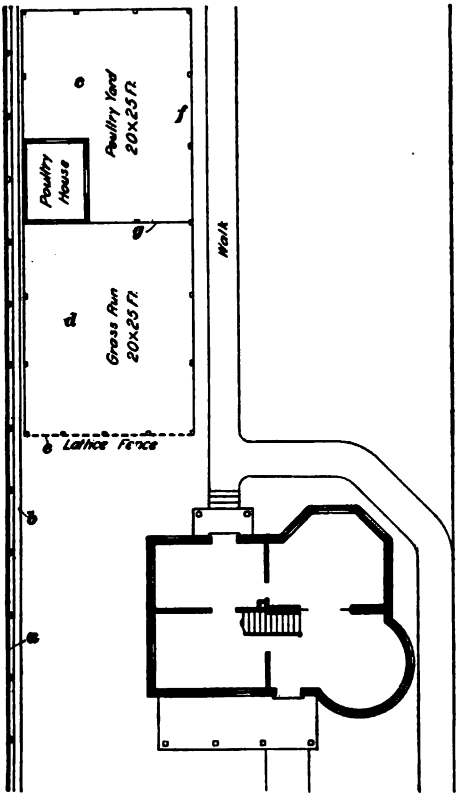


Fig. 12

Along the side of the lot in the rear of the poultry house is a closely built board fence *a*. Next to the fence is a gutter *b*, made of brick or cement, with a fall to the rear of the lot. The grade of the yards *c* and *d* is away from the line *f* and toward the gutter, so as to turn the surface drainage away from the path and from the yard of the house. The poultry yard is divided into two parts, each 20 feet wide and 25 feet long, by a wire fence *g*. One of these yards is for an all-day runway, and the other is for a runway where the fowls may go occasionally for a green-food supply. The entire poultry yard is enclosed by a 5-foot fence, which may be of 1½-inch mesh galvanized poultry netting or of galvanized poultry fencing. Across the front is a latticework *e* to hide the poultry house and yards from view. If there is no natural shade, an awning should be placed over a part of the poultry yard during warm weather.

A house 6 feet wide and 8 feet long will be sufficiently large for twelve hens.

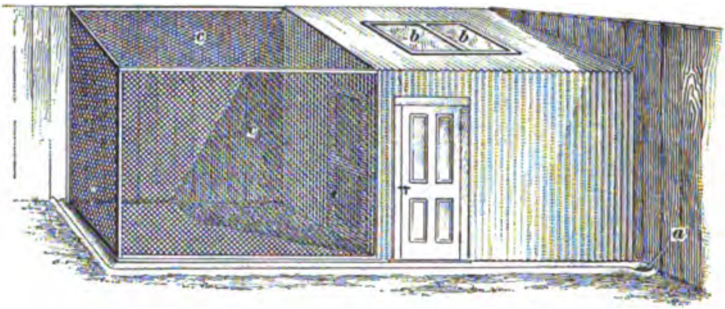


FIG. 13

13. City-Lot House.—A limited number of hens can be kept in the back dooryard of a city home, provided sanitary conditions are maintained. Where there is a rear entrance to the home, with the door or gate at one side, the poultry house can be placed on the other side, in the corner and against the fence, as shown in Fig. 13. In order to maintain sanitary conditions in the limited space of a city dooryard, it is necessary to lay a cement floor in the poultry house and yard, and there should be a cement gutter around the floor to turn the water into the sewer. The drainage should be into the sewer at the corner *a*.

The house illustrated, when intended to be placed on a city lot, should be made of corrugated iron, and the window, which consists of strips of heavy wire glass *b*, should be in the roof, so as to admit sunlight into the house. Both the frame of the house and that of the yard, in which provision is made for doors and windows, are of heavy galvanized iron into which

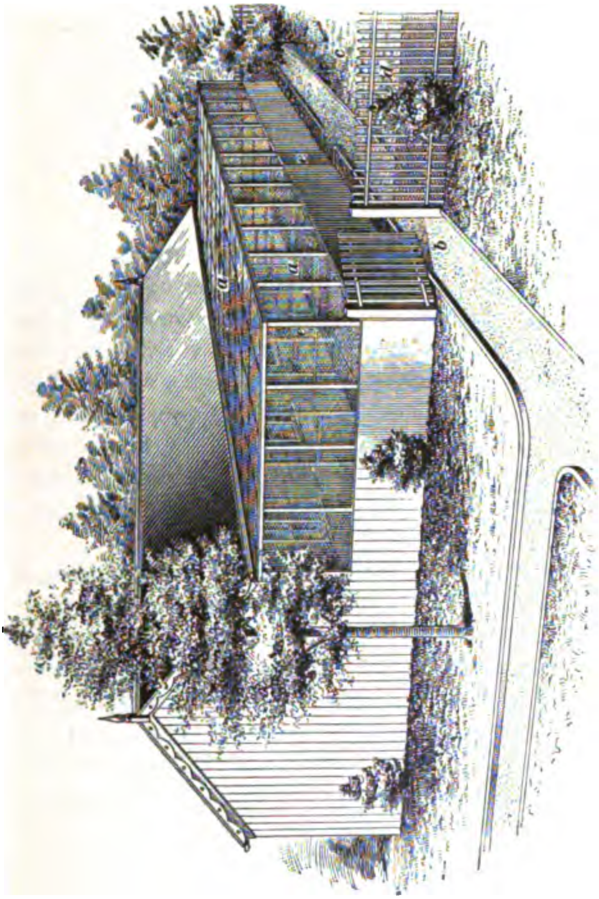


FIG. 14

the corrugated-iron sheets of the sides and roof are fitted. The yard is enclosed above, in front, and at the end by means of heavy wire screen *c*.

The cement floor of this house should be covered with a board floor made in sections, so that it can be taken up occasionally and the cement floor covered with ashes in which the hens may scratch. This will be a relief to the hens, and after a time the ashes can be gathered up and hauled away and the house thoroughly cleansed, when the board floor may be replaced for another period, if desired. The nests, roosts, and dropping-board are located in the corner of the building. If desired, a movable table or dropping-board with nests may be used, and the equipment as well as the house may be of iron. A combination nest box, roost, dropping-board, and dust bath is made of wood or metal. The metal box affords protection against fire and mites.

14. House for Well-Bred Stock.—When well-bred fowls are kept for producing exhibition stock, there must be sufficient room for separate pens in the house, separate yards into which the different flocks can go for outdoor exercise, and also a separate yard, or park, for the chicks and growing stock. This arrangement will require considerable space if such stock is raised on a large scale. A house and yards suitable for fanciers and designed for a town lot is shown in Fig. 14. If ground space is still more limited, the number of pens, yards, and flocks must be smaller.

The general plan of this house, both inside and outside, is similar to that of the apartment house described in *Poultry Houses*, Part 1, and the partition, nests, and roosts as shown there can be adapted to this house by making the necessary changes to fit the space. The covered runs *a* in front of the house come to the line of the walk *b*. The park, or yard, *c* for the mother hens and chicks is in the front of the covered runs. The yards and the park are separated from the front lot by a picket fence *d* to prevent the young chicks from wandering beyond the fence line of the park. To insure the safety of the chicks, there should be a close wire netting inside the fence and along the walk. The wire netting along the walk is not shown in the illustration on account of obscuring other details. The park should be planted with trees and bushes for shade, which will prove of much benefit to the fowls during hot, summer days.

The entrance *e* into the poultry house is from the front into a hall, at the rear end of which is a narrow passageway extending right and left to the division line of the last pen on each side. This provides an entrance to all pens and allows the last one on each side to be the full depth of the building. If necessary, the hall may be dispensed with entirely and the entrance made from one pen to the other by a door in the partition. The window sashes are movable in slides, and may have glass or be covered with cotton cloth, as desired.

HOUSES FOR BANTAMS

15. Box House.—A small house is suitable for Bantams; the smaller the house, the less space there will be for their bodies to warm, and the more comfortable they will be during very cold nights. The **box house,** illustrated in Fig. 15, can be built out of packing cases that are 3½ feet wide, 4½ feet long, and of the average height, the front elevation of the building being 4½ feet and the rear elevation 3½ feet. The floor of the house, which is made first, is 4 feet wide and 5 feet long, and is elevated 12 inches above the ground by cleats nailed all around on the under side flush with the edge. The walls of the house are nailed to the edge of the floor, the boards in the rear and on the sides resting on the ground, closing the space under the floor on three sides. In front, the boards extend 6 inches below the floor and to within 6 inches of the ground, leaving an open space *a* of 12 inches

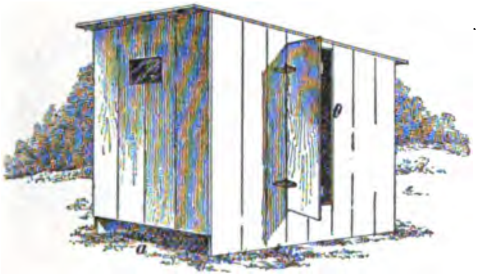


FIG. 15

under the floor. When the siding is in place the roof is put on and covered with roofing paper.

One 8″ × 10″ pane of glass in front admits all the light that is needed; the single-board door admits the Bantams and permits the gathering of the eggs and the cleaning of the house. A round roost pole across the rear end and some small nest boxes complete the house. This house will provide quarters for ten or twelve Bantams. It can be moved beneath the shelter of a tree during the summer months, placed under a shed or moved to the basement during severe cold weather, or left in the open throughout the entire year. It is, in fact, a comfortable house for Bantams in all kinds of weather. The dust bath for the Bantams is beneath the house. When the nights are cold the open space *a* in front should be closed. In localities where it is very cold, and where there are spells of severe weather, the outside of the box should be covered with tar paper to close the cracks against the wind.

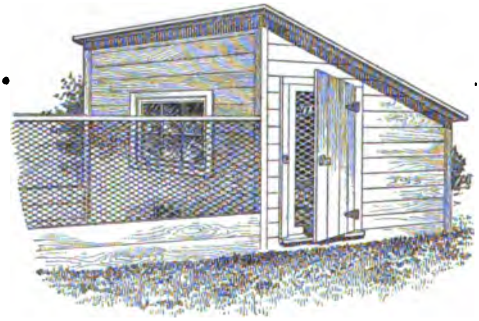
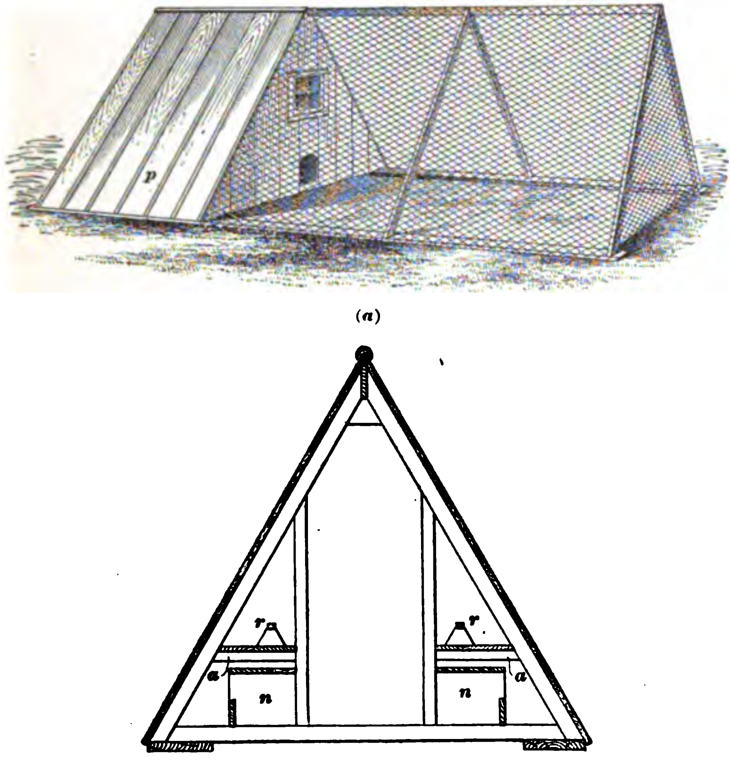


FIG. 16

16. House for Asiatic Bantams.—For Brahma or Cochin Bantams, a low, compact house is the best. These Bantams can withstand the coldest weather if they are as well protected as are other fowls. The house shown in Fig. 16 is 8 feet long and 6 feet wide; it is 6½ feet high in front and 5 feet high in the rear; the fence for the enclosure is 5 feet high. If desired, this house can be divided through the middle and be used for two separate lots of Bantams. When this is done, a division fence should separate the two pens. The interior of the house may be like that of any of the small houses; the arrangement described in *Poultry Houses*, Part 1, for the two-room house is preferable, and the same equipment will do for this house by moving the nest boxes to the rear and opposite the roosts. The building has a double door, the inner screen door *a* swinging to the inside and the board door swinging to the outside. The outer door should be left open during warm weather and on bright days during cold weather to prevent dampness. The house should have a board floor.



(*a*)

(*b*)

FIG. 17

17. Apex House.—Light-built, movable houses for Bantams are satisfactory, and are sometimes no larger than an ordinary brood coop; when as small as this, they may be moved from place to place at night while the Bantams are on the roost. The larger houses of this kind should have runners. A movable house with yard attached may be built **A**-shaped on a continuous frame, one end of which is enclosed with boards and made into a house and the other part of the frame covered with wire netting and used as a yard for the fowls. A house of this kind is shown in Fig. 17. The frame is 16 feet long, 6 feet high, and 6 feet wide. One end of the frame to a length of 6 feet is enclosed for the house *p*, and the remainder is covered with woven wire to complete the enclosure. This house has 36 square feet of floor space and is large enough for ten or fifteen Bantams. The dropping-boards and roosts *r* are placed very close to the sides and rest on the braces *a*. The nest boxes *n* are beneath the roosts. A house like this can be moved about as the poultryman sees fit, or whenever it is necessary to freshen the yard or to improve sanitary conditions. The same style of house, but of larger size, may be used for housing and yarding fowls of all kinds. It should be moved to a new location frequently enough to prevent contamination of the ground on which the house has been located. When houses are moved, the ground on which they stood must be gone over thoroughly with a rake, all the filth taken away, and fresh earth turned up. It will be well also, to sow grass

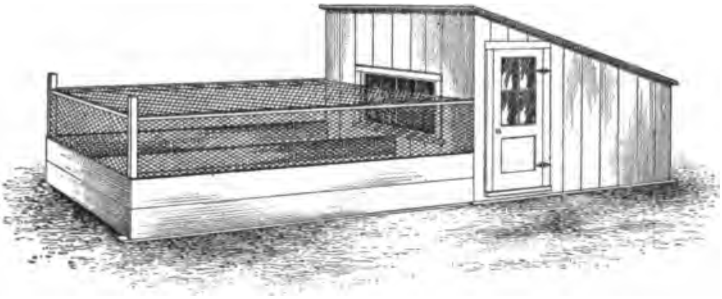


Fig. 18

seed over the scuffled surface and lightly rake the seed into the ground.

18. Shelter House.—Fig. 18 shows a convenient **shelter house** for Bantams and for a few fowls of any kind that must be confined within a yard or enclosure. This house, which should have a hard floor, may be built with a yard attached or with the house and yard separate. The building may be simply a frame covered with heavy roofing paper and the runways enclosed with wire netting, or they may be built of lumber and wire netting as shown in the illustration. The house illustrated is 6 feet high in front, 4 feet high in the rear, and 8 feet long; it is divided into two pens, each pen being 4 ft. × 6 ft. The roosts and dropping-boards are in the rear part of each room and the nests are placed beneath them. The yard is also divided into two parts. The partition between the pens is similar to that described for larger houses, and is made of lumber and wire netting. The window in front of the house admits light into both pens and both ends of the house are provided with doors like the one shown. By means of these doors the house may be easily cleaned. If desired, this kind of house may be made 5 feet high in front, 4 feet high in the rear, and with a floor space 5 ft. × 6 ft., a corresponding reduction, of course, being made in the size of the run.

The yard is made as shown in the illustration, the division through the middle being made of lumber. The outside framework is covered at the sides, ends, and on top with woven wire. The corner posts should extend above the top of the window, and are made of 2″ × 4″ scantling. Where there is no shade to protect the fowls from the direct rays of the sun during hot weather, an awning should be drawn over the run and fastened to these corner posts. The awning should not be used during the night, nor will it be needed during wet, cool, or cold days. Both the house and the run can be built on runners to facilitate their transportation.

HOUSES FOR MISCELLANEOUS PURPOSES

19. House for Exhibition Fowls.—A house with at least three rooms is required for the care and preparation of fowls for exhibition. Two of these rooms are used for the breeding fowls and the young stock, and in the third room are placed coops for holding the surplus males and training coops in which the specimens for exhibition are placed before they are sent to the show. To have all these necessities in limited space demands an arrangement of the interior that divides the space in the most advantageous way possible. A small house of this kind is shown in Fig. 19. This house may be used either for Bantams or for large fowls. Such a house may be built 8 feet wide and 16 feet long, but if space will permit, it is well to make it 10 feet wide and 20 feet long. This latter size provides 200 square feet of floor space in which ten hens, twenty pullets, and fifteen or twenty male birds may be distributed. The hens and pullets are put in the pens and the male birds in the coops. Even more than this number may be kept, provided they are disposed of quickly or the birds in the coops are shifted at times to the pens where they can exercise.

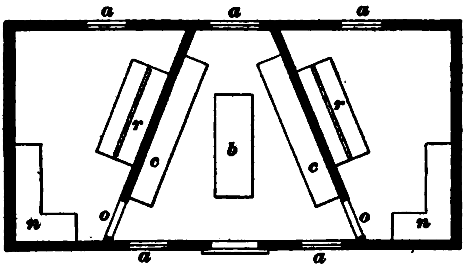


Fig. 19

Whenever possible, the house should face the south. As shown in the illustration, there are three windows *a* in the front of the house and two in the rear, and the entrance into the house is from the rear into the middle room. The shape of the floor space allows the exhibition coops *b* to be placed in the center of the middle room, where the light from the three windows will shine on them. On each side of the room there is a coop *c* either for male or for female birds. These coops should be large enough to have three or four fowls in them without crowding. If the birds do not fight, several will do better together than they will in separate coops. These large coops can be used as pens for three or four fowls, or for a larger number of Bantams. The exhibition coop in the middle of the room is used as a training coop, in which fowls that are intended for the show room are taught good behavior. In each of the other rooms, the dropping-board and roosts *r* are placed against the partition wall, which is built of flooring and extends above the top of the coops. The nests *n* are placed in the rear corner of the pen; the doors *o* leading into the pens are just inside the front door to the right and left of the middle room. The style of door used may be like any of those shown for other houses. A house of this kind should have a board floor laid on concrete, the floor being elevated at least 4 inches above the outside ground level.

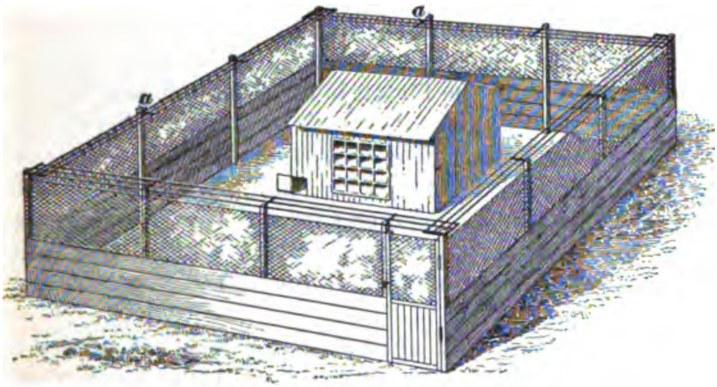


FIG. 20

20. House for High Flyers.—Nothing in poultry keeping is more vexatious than the attempt to keep within bounds high-flying fowls without cutting the ends from the primary, or flight, feathers of their wings. Such fowls can be kept within the enclosure by using fences 8 feet high made of poultry netting, and also by covering with netting the top of the pens having lower sides. These methods are not entirely satisfactory because of the fact that, unless a strong frame is built to support it, the netting sags or hangs down. There are several kinds of safety fences in use; one of the most satisfactory of these fences is shown in Fig. 20. The house for the fowls is in the center of a square pen that is made with a safety fence. This fence is 8 feet high, the lower 4 feet being made of four boards, each 12 inches wide, and the upper 4 feet being made of galvanized poultry netting. The fence posts extend 6 inches above the top of the netting. Pieces of flat iron *a* 16 inches in length are fastened against the sides of the posts near the top; through each one of these pieces are three ¼-inch holes, through which steel wires are drawn, as shown in the illustration. These three strands of wire form a net that turns the fowls back when they attempt to fly over the fence. This fence is effective because fowls usually begin their flight near the fence when they try to fly over it. This kind of house and fence is best fitted for open lawns, fields, or parks where high-flying fowls, jungle fowls, or pheasants are kept, and where they must be confined.

21. Open Shed.—An **open shed** is almost a necessity on a farm where there is little or no shade or shelter for the fowls. In fact, an open shed is of great value on any farm where large numbers of fowls are kept, its value being due to the daylight shelter given the fowls during bad weather. The increased egg yield from the sheltered fowls will soon pay for the cost of the shed. The open shed may be a low structure or it may be sufficiently high to permit a horse and wagon to be driven under it. The shed should be open to the south, and the floor should be raised at least 4 inches above the ground level. By the use of heavy timbers for the base an enclosure will be formed. This enclosure should be filled with coarse gravel from which all the large stones have been removed. Inside of a house like this, brood coops for the mother hens and chicks may be set. The brooder may also be placed there early in the spring when it is too cool and damp for the chicks to be in the open, and late hatched broods may be sheltered beneath the shed roof in the fall. When it rains, snows, or blows, all fowls, old and young, can go under the shed for shelter; and during the hot nights of summer, the growing chicks may go there for shelter and to roost. The shed shown in Fig. 21 is 18 feet deep and 40 feet long. The same kind of a shed, of course, may be built larger or smaller at will.

22. Enclosed Shed.—Where poultry is grown for market, an **enclosed shed,** or **house,** to be used as a shelter for growing chicks and for other purposes should be provided. The nests for the broody hens, the incubator, the brood coops for the hens and chicks, and the brooders may all be sheltered in an enclosed shed. The turkey hen and her young may also be confined in a portion of the house for a season, so as to protect them from the damp; and during the entire summer all kinds of young fowls can go into this shed for protection from the sun and rain. The enclosed shed shown in Fig. 22 is intended for the several purposes mentioned, and can also be used as a place for fattening the fowls in coops during the fall and winter. This same house may also be used for the killing house for all kinds of market poultry. The house is

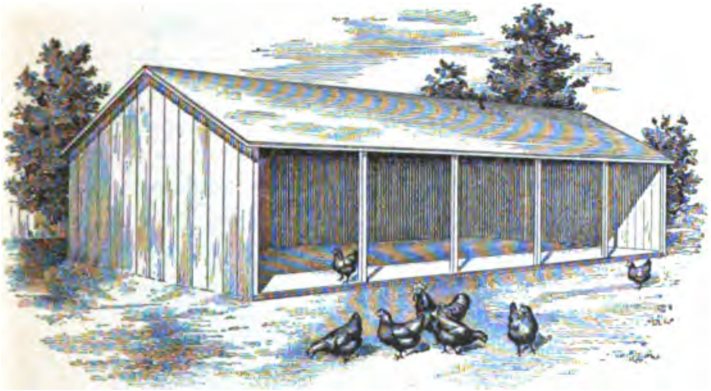


Fig. 21

12 feet wide and 16 feet long; the floor should be made of cement, and the drainage should, if possible, be toward the center into a sewer pipe; this drainage will be of advantage during the killing season.

The south side of the house has hinged doors *a* 3 feet wide above the floor. Behind the doors are movable frames *b* covered with slats, which are used when the house is occupied by growing stock. Both the door and the slats are removed during the summer months. The upper portion of the front is made partly of glass; the remainder is occupied by doors *c* that close over the glass windows; these doors may be opened during hot weather. The ventilator *d* in the roof carries away the heat and steam; the chimney is for the cooking stove on which water is heated and the mash feed cooked.

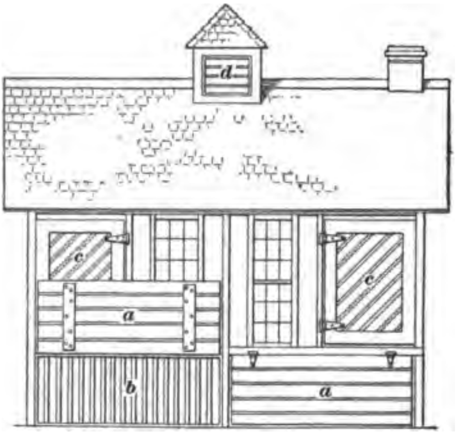


FIG. 22

23. House With Removable Front.—Houses having removable fronts are best suited for changeable climates where the summers are hot and the winters are cold. The type of removable front shown in Figs. 23 and 24 can be made to fit any house. The front *a*, Fig. 23, is used during winter months and has two glass windows, one on each side of the cloth window *d*. During the summer, this front is removed and the wire-covered frame *b* put in its place, as shown in

Fig. 24. This change transforms the winter house into a warm-weather house, through which there will be a free circulation of air without strong currents. A strong canvas curtain 3 feet wide to serve as a shield from the winds may be tightly drawn across the front close to the floor. The nests, dropping-board, and roosts should all be movable, in order that they may be readily removed from the house and cleaned; the roost holders *c* should be so made that they will provide little shelter for mites and other insect pests. The dropping-board below the roost rests on four blocks, one at each corner, the blocks being fastened to the wall. The blocks should be of small size so that little shelter for mites will be provided.

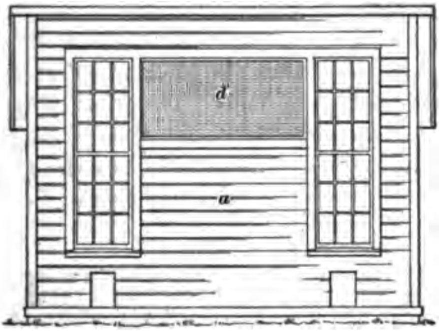


FIG. 23

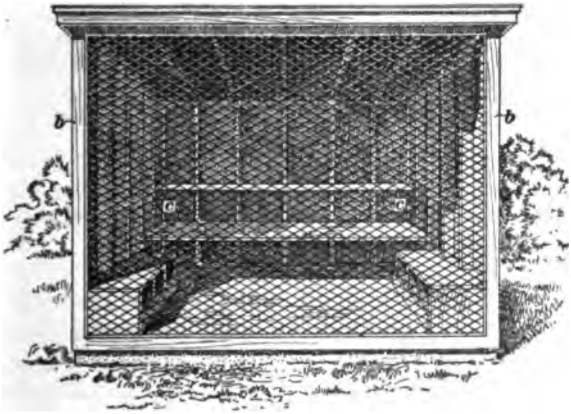


FIG. 24

HOUSES FOR THE TROPICS

24. House With Open Front and Side.—In warm climates within the tropics or near them, where there is perpetual summer, the buildings for poultry might well be open sheds were it not for the fact that the fowls must be protected from rats and larger animals and also from other dangers. A house that will serve this purpose is one that is close built in the rear, at one end, and overhead, and has the front and other end enclosed with screen wire. The house should be located so that the closed sides will protect the poultry from the prevailing winds of the locality.

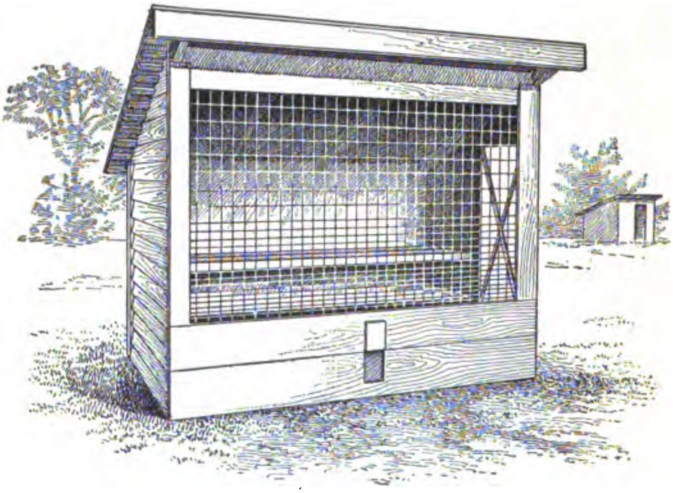


FIG. 25

25. Corrugated-Iron House.—Houses that are built mainly of corrugated iron are well adapted for the tropics. The floors and roofs of the houses should be made of corrugated iron, and the first 4 feet above the ground of side and end walls should be built of the iron and the upper part of wire screen. Houses of this kind will be satisfactory for all localities where warm weather is continuous and where the fowls must be protected at night from destroying animals.

The floor being of iron, prevents animals from burrowing beneath it, and the side walls are strong enough to keep out all intruders. The open screens above admit plenty of fresh air, and if the nights are cool, a curtain of burlap may be hung over the screen to protect the fowls from cold currents of air.

26. **Safety Shelter.**—Sufficient protection for fowls that are kept in hot climates may be obtained by using a house like the one shown in Fig. 25. Safety shelters of this character are especially suitable for a warm climate. This house is 7 feet high in front and 5 feet high in the rear. The floor is 8 feet long and 5 feet wide and is made of matched lumber. The roof overhangs in front and is covered with shingles. The dropping-board is placed 30 inches above the floor and the nests are beneath the dropping-board. A house of this kind is large enough for twenty-five hens. Much less room will do for the hens in a warm climate than is necessary for them in the colder climates, for the reason that in a hot climate the fowls occupy the house only when laying and roosting. Three roosts 8 feet long across the rear of the building provide roosting space for the twenty-five hens; the small door in the front of the house is for the hens to go through, the eggs being gathered from the nests through a hinged door in the side of the house. Everything within the house can be readily removed for cleaning, this being a most important feature for houses adapted for use in the warmer climates. Such a house can be used as a colony house, for sheltering growing pullets, or for laying hens. It is both small in size and light in weight; hence, it can be quickly moved from place to place on a drag sled or on slides of wood.

27. **Adobe House.**—In some districts of New Mexico, Arizona, and in other localities where the same weather conditions prevail, houses that are built of corrugated iron, as previously described, serve two purposes, that of providing shelter from the weather and protection from animals that are apt to visit the poultry house at night. The close walls serve as a wind break above the heads of the fowls on the

roosts; and the open screen above admits the fresh air. Within a house of this kind, there will be about the same temperature for the hens on the roost as they would have in the same locality if roosting among the branches of the trees. When houses like these are used in the high altitudes, curtains of muslin or burlap should be drawn over the wire screen during the cool or cold nights, and removed or rolled up during the day. The daily temperature variation in some of these localities is great, ranging from 40° F. at sunrise to 80° F. or more at noon. Where conditions of this kind exist, no houses are better than those built of **adobe,** or sun-dried bricks, which are used for many purposes in dry climates. An adobe house should be plastered inside to prevent vermin from collecting in the openings of the walls.

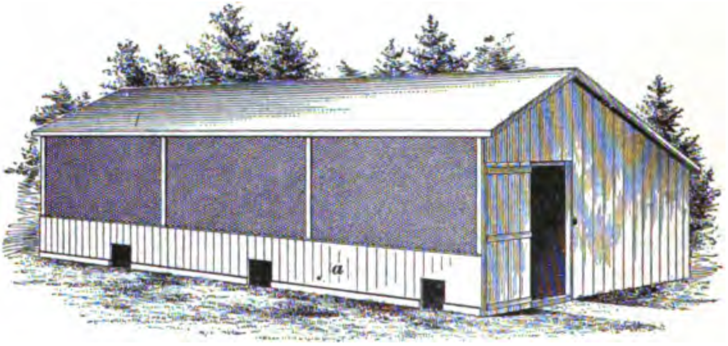


FIG. 26

28. Open-Front House.—The practical poultry house for use in the warm climates is one that shelters the fowls from inclement weather and prevents drafts. A house of this description will not be intensely hot at noonday, nor will it be sultry and close at night. The open-front house, as has been said, is best for a warm climate, but when this house is being built, proper consideration must be given not only to the shelter and protection to be provided, but also to changes in the weather. The house must have complete ventilation without the unrestricted circulation of cold currents of air during the night. The house shown in Fig. 26 is suitable for any locality where frost is unknown. This house is 16 feet wide and 50 feet long; the entire front above the baseboards *a* is open and has no other covering except the woven-wire screen. It has a double-slant roof and is 8 feet high in front and 6 feet high in the rear; the distance from the floor to the ridge pole is 10 feet. This arrangement gives a larger opening in the front, with the use of but little lumber. The interior of the house may be divided into four or five sections by the use of wire-screen partitions, or it may be used without being divided. This house will accommodate 300 laying hens of medium size, or from 350 to 400 Leghorns may be kept in a house of this kind, provided the best sanitary conditions are maintained. For each 100 hens kept in the house, 75 feet of roosting poles must be supplied.

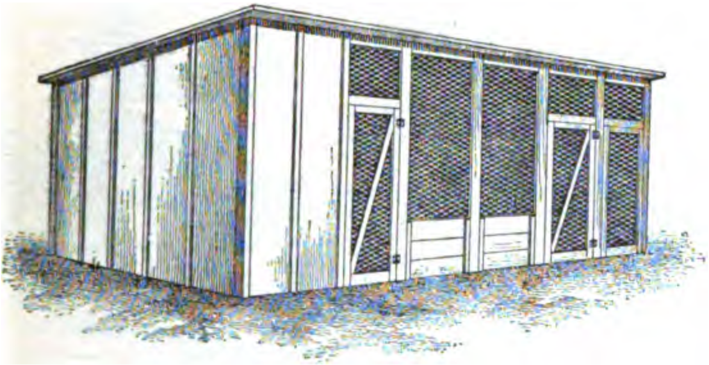


Fig. 27

The dropping-board should be high enough above the floor to allow space below it for the nest boxes. An open space is left between the top of the nest boxes and the lower side of the dropping-board, and also between the nest boxes and the floor, to permit all the parts to be thoroughly cleaned. The roosts and nests are movable, to facilitate cleaning. Openings should be left in the rear wall through which the eggs can be gathered and the dropping-boards cleaned. These openings are like those shown in Fig. 28, which illustrates the rear view of a tropical colony house. These houses should be built under the shelter of shade trees when it is possible to do so, and they should always be located where they will be accessible for frequent cleaning.

29. Colony House for the Tropics.—A colony house that can be used to advantage in the warmer climates is shown in Figs. 27 and 28. This house is 8 feet wide, 16 feet long, 9 feet high in front, and 6 feet high in the rear. The house is divided into two pens, each of which will accommodate a flock of fifty Leghorns. The houses are built as nearly air-tight as possible on all sides except the front, which is made of wire netting. A front view of the house is shown in Fig. 27 and a rear view in Fig. 28. In localities where the nights are cool during the winter months, burlap curtains should be drawn over the front whenever they are needed to shield the fowls from the cold air. If the house has an earth floor, it should be gone over each week with a fine-toothed iron rake, and the surface of the floor freshened frequently with a covering of clean, dry earth. A dropping-board for 100 hens will occupy about three-quarters of the space above the floor and the hens must go beneath this board when going into the nests. The nest boxes are raised 12 inches above the floor and have a 6-inch open space between them and the dropping-board. The eggs are gathered through doors *a*

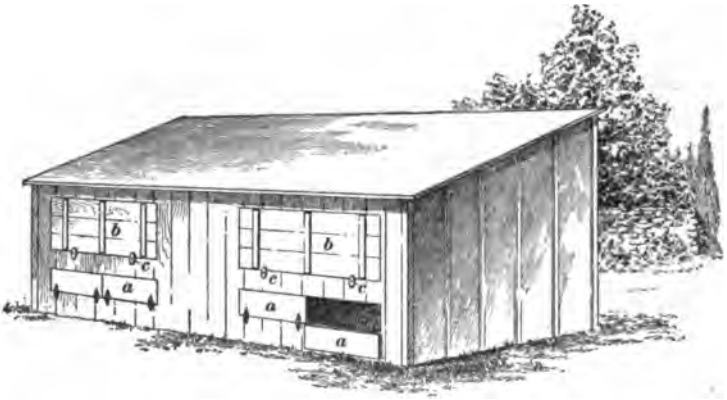


Fig. 28

in the rear, and the droppings are scraped from the dropping-board through other doors *b* that are above the nest openings. The doors *b* through which the droppings are scraped are movable. Flat pieces of iron are fastened on the inside of the rear wall and these pieces project a short distance over the door opening, thus making it possible for the buttons *c* to hold the doors in place. Such doors can be removed during the day and screen wire put in their places. The screen doors may also be used at night during sultry weather, and solid doors in the daytime during cool or windy weather. For cleaning the dropping-board, a flat-bladed scraper, or hoe, is used from the rear and a rattan brush from the front. By the use of these tools the filth will be swept back through the opening away from the poultry yards. If the nests are made of tin or galvanized iron, there will be little chance for mites to live in them. If the nests are movable and placed on rods for support, even less trouble will be experienced in keeping the house free from insect vermin of all kinds. A continuous watch must be kept over the interior of all buildings used for poultry in tropical climates because hen lice, mites, ticks, and other kinds of insect vermin find harboring places in every available spot within. To combat these pests successfully, every possible precaution to insure tightness and cleanliness should be taken in building and equipping the house.

SELECTION OF A POULTRY HOUSE

30. In selecting and building a house for the hens, a plan that will meet the necessities of the locality should be chosen. A house best suited for the tropics should not be built in a cold climate, nor is it wise to incur the expense of building in warm climates houses that are needed only where it is excessively cold. All that has been said relative to location, soil, drainage, houses, equipment, and appliances should be weighed well, and the house that is best suited to the purpose intended should be the one selected, provided of course its cost is not prohibitive.

31. Where there are frequent weather changes it will be necessary to have a house that can be readily transformed to meet the requirements of the hour. Where the thermometer records changes in temperature that range from 80° F. at noon to 40° F. at midnight, it will be necessary to guard against cold and damp. In localities where there is this daily range of temperature there is seldom if ever a season in which the temperature will be at all uniform. For use in these localities, the house that has the most even temperature at nights should be selected.

32. Of all the different types of houses described, none will prove more satisfactory for a changeable climate than the house with the front partly of glass and partly of cloth windows. The apartment house with a hall in the rear will also prove desirable for a limited number of fowls where the weather conditions are changeable, provided that it is properly equipped and that its front is partly of glass and partly of cloth.

33. A house with openings in the walls or roof that permit the air to pass through will be unsatisfactory. To control the ventilation the house must be tightly built and free from cracks. If protection from storms is all that is needed, any kind of an open shed with a tight roof will do for a poultry house. Fowls require more than shelter; the prevention of drafts is absolutely necessary for their health, and it is therefore essential that the walls as well as the roof be made as tight as possible. If careful attention is given to these points, no one that is familiar with the climatic conditions to be encountered and that has the other necessary information should make any serious mistake in building a poultry house. Whether the glass window or the cloth window shall be adopted, can best be decided after a careful reading of *Poultry Houses*, Part 3. But on one point there need be no hesitation—the house without holes, cracks, or crevices through which the cold air can blow, is the one desirable for profitable poultry keeping. The value of the air-tight house is shown by the fact that in houses that are not air tight currents of air pass over and around the fowls and cause continual trouble from cold and roup, even during moderate weather.

34. All the air admitted to a house at night, except during hot weather, should be through the front. An open-front house is the one to select for warm climates, and with the addition of the muslin-curtain front, this type of house may also be used in more temperate climates even during the colder portion of the year. With a front of part glass and part muslin, the same kind of house may be used in still colder localities, provided, of course, that it is tightly built. In order to regulate the temperature of the interior of the house, the windows must be opened or closed, according to the temperature of the outside air.

The open-front colony house or any house that has a muslin front can easily be changed into a fresh-air house for summer use. This change is accomplished by removing the regular front and replacing it with a woven-wire screen.

35. House for the Farm.—In selecting a house best suited for a farm poultry plant, all conditions that are to be met with, both in the present and in the future, so far as they can be foreseen, should be taken into consideration. For a flock of about 100 hens, having the freedom of the farm, preference may safely be given to the combination house, and for larger flocks the house for general use may be selected. Both of these houses are described in *Poultry Houses*, Part 1. For special flocks of hens kept for egg production during the winter, the apartment house of many pens can be taken. No mistake will be made in the selection of any of these houses for the farm, and in no other place does poultry require better housing. But while all the houses recommended are excellent, it must not be forgotten that the poultry house and the poultry must be looked after and cared for as diligently as are live-stock and their quarters.

36. House for a Few Hens.—If only a few fowls are to be kept, either the one-room or the two-room house should be selected, unless more pretentious quarters are desirable to beautify the surroundings or to be in keeping with them. An excess of house room should be avoided, however. As a rule, the beginner is inclined to keep more fowls on a town lot than the space will permit, and if the houses are larger than need be for a few hens, the tendency will be to keep more than there will be range for. Twenty-five fowls are enough to keep on the average town lot—fewer are desirable.

37. House for Exhibition Fowls.—For raising well-bred exhibition fowls, the house illustrated in Fig. 14 or either of the cold-weather houses described in *Poultry Houses*, Part 1, may be selected. These cold-weather houses can be modified to suit climatic conditions; for a warm climate the partition between the pens should be made of wire. If an inexpensive exhibition house is desired, an apartment house with hall may be chosen and built to any length. In a house of this kind, any reasonable number of pens or apartments may be built; but it is not wise to have a building so long that it will be laborious to care for it. This objection may be overcome to some extent by the use of side doors to the hall. These will not, however, furnish a satisfactory exit for the wheelbarrow or cart that must be used in feeding the fowls and cleaning the house.

POULTRY HOUSES

(PART 3)

VENTILATION

WINDOW VENTILATION

1. Fowls on the roost must be supplied during the night with fresh air, which can be admitted safely, when the weather is warm, through open windows. When the weather is cold, ventilation can be accomplished by means of a few simple devices that must be carefully watched and regulated. If these things are done, little, if any, ill effect will follow the most severe weather changes. In houses that are properly built, safe ventilation during sudden changes in the weather is secured by giving prompt attention to windows and other ventilating appliances. Should such changes in the weather go unheeded, any evil consequences must be charged to the neglect of the attendant and not to bad ventilation.

The materials in common use for windows in poultry houses are glass, cloth, and wire screen, or a combination of them. A house that has only glass windows is known as a glass-front house; a house in which the window openings are covered with cloth is known as a cloth-front house; and a house in which the window openings or the entire front is covered with wire netting is known as an open-front house. Glass-front, cloth-front, and open-front houses are all satisfactory, so far as ventilation is concerned, if proper attention is given to them.

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2. Glass Windows.—Sunlight is admitted to the poultry house by means of **glass windows.** Sunlight is of prime importance and must be supplied to all parts of the house; in addition to lighting the house, sunshine warms and dries the air contained therein. The amount of glass needed in a house depends on the space that is to be ventilated and supplied with light and heat. In order that the sun may shine to the very rear of the building, the windows in the front should extend as nearly as possible from the floor to the roof. One window of ordinary size is sufficient for a house 10 ft. × 12 ft. There should be one window for each 120 square feet of floor space in houses that are 12 feet or less in width, and one window for each 160 square feet of floor space in houses that are 16 or more feet wide. Just as wooden blinds, shades, curtains, or awnings are used in dwellings for protection from heat and cold, they can be used for the same purposes in poultry houses.

During winter, a poultry house can be safely ventilated through the opening made by lowering the sash from the top, or through the space between the sashes made by raising the lower sash 3 or 4 inches and closing the opening below with a board. If the sky is clear and the heat of the sun warms the house, the windows should be kept open in one or the other of these two ways no matter how cold it may be outdoors. Continuous ventilation of this kind during the hours of sunshine will prevent an excessive rise of temperature within the house throughout the day. In mild weather, this method of ventilation should be used during both day and night. If, however, there are other ventilators in the house, the windows should generally be closed at night when the weather is wet, cool, or cold, for it is not safe to have too much ventilation under these conditions.

3. Cloth Windows.—One of the best and most highly esteemed ways of ventilating a poultry house is that of using **muslin** or **cotton-cloth windows.** These windows are made by stretching the cloth over a frame that is made to fit into the window openings. The free passage of air through the cloth ventilates the house and prevents dampness. In winter, the temperature inside the house with cloth windows averages considerably higher than that of the outside air. Careful tests made at midnight show that while the temperature of a house with cloth windows was 6 degrees and that of a house with glass windows 14 degrees above zero, the outside temperature was 4 degrees below zero. Although the house with glass windows was 8 degrees warmer than the house with the muslin front, the advantage in temperature was more than balanced by the dampness with which it was accompanied.

In order to secure the full benefit from the use of a cotton-cloth window, its true mission should be thoroughly understood. Cloth windows promote the free circulation of air, which frees the interior of the house from dampness and unsanitary, unnatural conditions. Heating the air causes increased evaporation, and when the heated air of the poultry house becomes saturated with evaporated frost and other moisture it will, if confined, become foul with impurities. But if there is a free circulation of fresh air within the house the damp, foul air of the interior is forced out by the entrance of fresh air. The fowls within the poultry house that is ventilated by means of cloth windows possess all the advantages of living in the open air and are sheltered from the dangers of such a life. It is obvious that judgment must be exercised in the use of cloth fronts, for if there is more cloth front to the house than is needed, the difference between the house temperature and the outside temperature will be less than that mentioned in the foregoing paragraph. Not so much open space is necessary in houses in the far North as for those in warmer localities, but there must always be a sufficient surface of cloth to let in enough air to keep the interior of the house free from dampness.

4. Fabrics for Cloth Windows.—The fabric that is used for cloth windows must be strong and porous. Although muslin is mentioned most frequently as the best material, there is little real muslin used for cloth fronts. Several kinds of material, ranging from cheese cloth to heavy duck, are used, all of which are made of cotton. They are described as heavy cheese cloth, cotton-print cloth, muslin, sheeting, drilling, canvas, and light and heavy duck. Heavy cheese cloth is a standard material; unbleached cotton-print cloths, when printed, make calicoes; bleached cotton-print cloths are known in the trade as lawns; canvas is the material used by tailors for stiffening garments; duck is light-weight sail cloth. Each of these has found favor for cloth windows in some locality. The most open or porous of the materials is cheese cloth, which comes in several weights. When cheese cloth is used, the heaviest and strongest kind should always be selected. Cotton-print cloth is stronger than cheese cloth; muslin, sheeting, and drilling are all too closely woven for the free circulation of air. Nothing heavier then 10-ounce duck should ever be used. No one kind of material will fill the requirements of all sections; the best for any locality can be selected only after a trial of several kinds. The amount of cloth necessary to provide sufficient circulation for ventilation depends on the quality of the material; if a porous fabric like cheese cloth is selected, much less of it will be required than of heavy muslin or duck. The bulk of the evidence favors strongly the use of open or porous material for cloth, or curtain fronts in poultry houses. No paints, oils, or anything else that would prevent the circulation of air by closing the pores, or meshes, of the cloth, should ever be applied to the windows made from it.

5. Combination Windows.—To secure the most satisfactory results from the use of **combination windows,** a reasonable distribution of glass, cloth, and lumber must be made, the quantity of each depending on the floor space and the cubical contents of the house. Satisfactory results have been obtained when as much as two-thirds of the entire front was made of glass and cloth, while results equally good have been obtained with much less glass and cloth. More cloth should be used when the floor is wet than when it is dry.

6. Wire-Screen Windows.—Almost perfect ventilation is given by **wire-screen windows,** and if cloth curtains are used over the wire screen, the circulation of the air can be controlled during the coldest weather. The wire screen should be of a very fine mesh like that used for window screens to keep out flies. The front shown in Fig. 1 has a stationary glass window in the middle; on each side are movable frames, *a* and *c*, covered respectively with closely woven wire screen and 10-ounce cotton duck, that slide freely in the double slots *b* in (*b*). The wire-screen window is shut during all kinds of weather; when it is cold or windy, the screen is wholly or partly covered by pushing the duck-covered frame in front of it, thereby controlling the ventilation. The finest mesh wire screen is almost as closely woven as the most open cheese cloth, but owing to the absence of nap on the wire screen its mesh will not become closed and air will flow more freely through it than through the cloth. Because of this, it is not necessary to use so much wire screen as cloth.

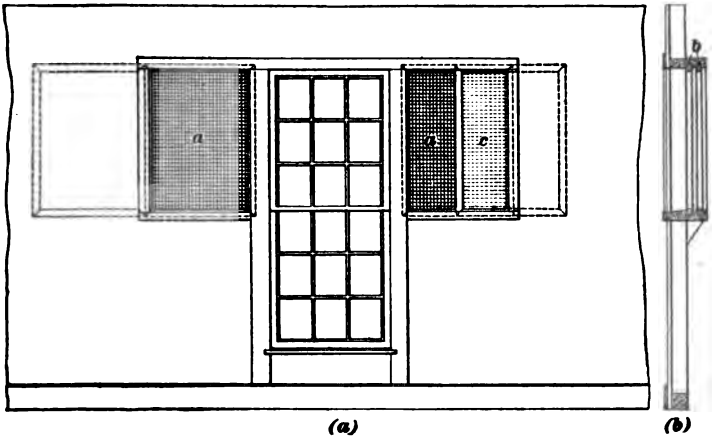


FIG. 1

Defective circulation may be improved by the substitution of the cloth-covered frame for the upper sash of the glass window, or the double windows of wire screen and cloth can take the place of the entire glass window. All window openings in poultry houses should be covered on the outside with wire netting, the mesh of which should not exceed 1 inch. The netting should be nailed fast and close to the outside of the window frame; it serves as a protection from outside marauders and prevents the fowls from going out through the window.

7. Size of Windows.—If cotton-cloth windows are used for poultry houses in cold climates, a house that is 12 feet square should have one glass window containing eighteen 8″ × 10″ panes of glass or their equivalent, and two cloth windows each 3 feet square. Where there are several pens under one roof, an equal amount of window space should be supplied to each pen 12 feet square. For houses that are 12 or 16 feet wide and 20 feet long, two glass windows and three cloth windows of the size described should be used. The arrangement shown in Fig. 2 is for a house 16 feet wide, 20 feet long, and 8 feet 6 inches high in front, the entire front of this house containing 170 square feet, one-third of which is glass and cloth. Narrow windows of glass that extend from near the floor almost to the roof, permit the sunshine to reach the extreme rear of the house. The lower edges of the curtain frames are 3 feet 6 inches above the floor; the frames are hung by means of hinges to the top of

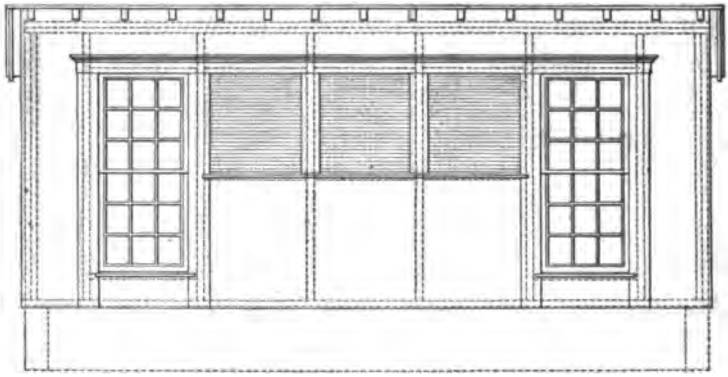


FIG. 2

the window openings so that the frames can be turned up against the roof and fastened there when they are not needed to reduce the quantity of cold air that comes in through the windows.

VENTILATION BY CIRCULATION

8. Houses that are air-tight or nearly so and that have double glass windows, are usually ventilated by opening the windows. It is possible, however, to obtain satisfactory ventilation in these houses by means of a chimney or a box ventilator built into the wall. Because plenty of cold air will find its way into the most closely built poultry house during winter weather, it is necessary to provide outlet openings only. Houses with cloth windows need no ventilation other than that secured by the windows.

9. Wall Ventilators.—The removal of damp air and bad odors may be accomplished by means of a small **box ventilator** built into the front wall of a poultry house. Such a ventilator is located between the two central studdings in the front wall of a small house. Houses more than 20 feet in length should have one ventilator for each 200 square feet of floor space, or at least one for each 20 feet of front. This box should be open at both ends and made like a grain chute of four boards, each 8 inches wide and 1 inch thick. There should be a sliding door 2 feet from the lower end, which should be within 15 inches of the floor; the upper end of the box must extend at least 18 inches above the highest point of the roof. The position of this box is like that of the ventilator shown in Fig. 3. The draft through the box, like that in a chimney, is better when the ventilator is warm than when it is cold. When the sun shines on the top of the ventilator and warms it, the air near the floor is drawn out of the house through the box pipe. During cold wet weather, the direction of the air-current in the ventilator may be downwards through the opening of the box into the house, just as contrary winds will blow down a chimney and force the smoke from the stove into the house. To prevent this reverse circulation, the slide door in the box should be closed at night and during cold stormy weather.

10. Suction Ventilator.—In Fig 3 is shown a **suction ventilator** made of 8-inch galvanized iron pipe. This type of ventilator will continuously draw the air from the house unless the lower opening *d* of the pipe *a* is closed. The pipe is located near the middle of the front wall of the house, and begins not more than 15 inches from the floor and extends at least 12 inches above the highest point of the roof, as shown in (*a*). On top of the pipe *a* is a revolving cap, or

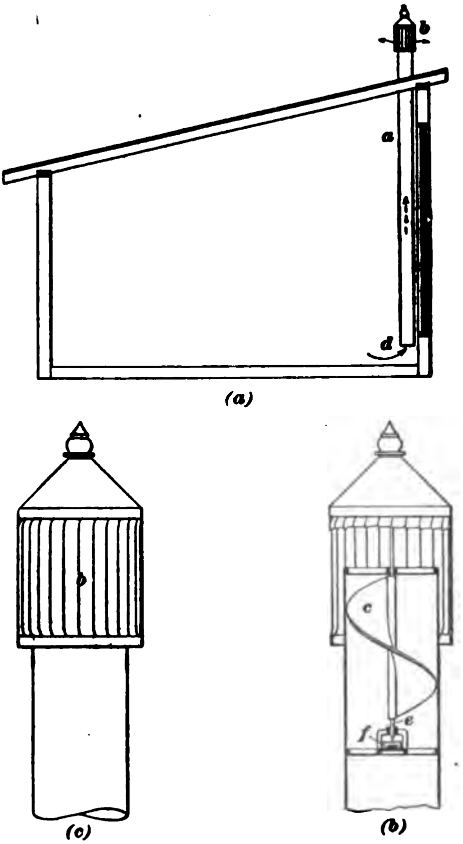


FIG. 3

turret, *b* made with louver fluting, which turns continually in one direction, the result of air-currents coming against it. Inside of the turret, as shown in (*b*), is a turbine wheel *c* attached to a steel rod *e*, the lower end of which terminates in a sharp point that rests on a piece of glass in a socket *f*; the upper end of the rod is fastened to the top of the turret. When the turret revolves, the turbine wheel turns with it and draws the air up through the pipe, thus forcing it out through the fluting. If this ventilator is in good working order, it is almost impossible for air-currents to pass through it into the house. A cover of galvanized wire cloth should be soldered over the lower opening of the pipe, and a close-fitting cap of galvanized iron should be used to cover this cap and the end of the pipe to stop the circulation of air in the pipe when ventilation is not needed. One of these suction ventilators is sufficient for a poultry house containing 360 square feet of floor space.

11. **Dangerous Ventilation.**—Warm air rises to the roof or ceiling of a house, while cold, damp air settles to the floor. Good ventilation removes the cold, damp air, and allows at least a portion of the warm, dry air to remain. An opening made through the ceiling or roof furnishes an outlet for warm air, but will not insure healthful ventilation; if the house is overheated, the hot air passes out through an opening in the roof, but when the air within the house is cold and damp, additional cold air may come in through any openings overhead. Ventilating shafts or open-box ventilators in the roofs should not be used on poultry houses in cold climates, as these ventilators carry out all the warm air and produce drafts of cold air in the house. If there are cracks or openings of any kind in the roof, currents of air will go through them into the house. In the cold climates, roofs of poultry houses should be perfectly tight and free from openings. The interior of the houses can be protected from cold if the rafters are covered inside with laths and plaster or a sheathing of boards. Ventilating shafts through the roofs of poultry houses can be used to advantage in hot or tropical climates.

EQUIPMENT

DROPPING-BOARDS

12. The board platform beneath the roost is put there to catch the droppings, and to prevent them from becoming scattered about and mixed with the grain that is fed in the litter upon the floor. This board for droppings should be smooth and level on top; it will serve best if made of surfaced tongued-and-grooved flooring with the joints filled with white lead. In order to facilitate cleaning, the boards should be free from loose knots or holes, and should be laid straight from front to rear. Dropping-boards may also be made of one wide board or of several boards of any kind of lumber joined together and covered with zinc, galvanized iron, or tin. The platform may be either stationary or movable. A movable platform is more easily cleaned than a stationary platform. The roosts are placed 6 or 8 inches above the dropping-boards, and are located so that each fowl will have a roosting place directly over the platform. The excrement that accumulates on the dropping-boards should be removed at stated intervals, and the boards cleaned and sprinkled with dry earth, sand, or land plaster. The ease and speed with which the boards may be cleaned and the preservation of the manure should be considered when selecting an absorbent for use under the roosts.

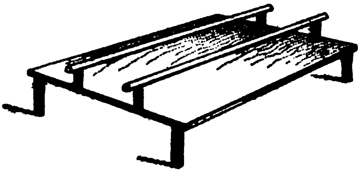


FIG. 4

13. Table Platform.—A bench or **table platform** carrying roosts is the most convenient style of movable **dropping-board**. **The small table shown in Fig. 4 is a movable platform**

that can be used in any house; it is light and can be moved about easily or taken outside the house to be cleaned. This type is used in colony houses, coops, or open sheds as a roosting place for young chicks. A more elaborate platform of a similar type is shown in Fig. 5; this platform has roosts, dropping-board, and nests combined. In the front are hinged doors through which the eggs are gathered, the hens entering the nests from the rear. This table platform should be built only high enough from the floor to permit the hens to pass under the nest boxes. A dropping-board 30 inches above the floor is sufficiently high for heavy bodied fowls.

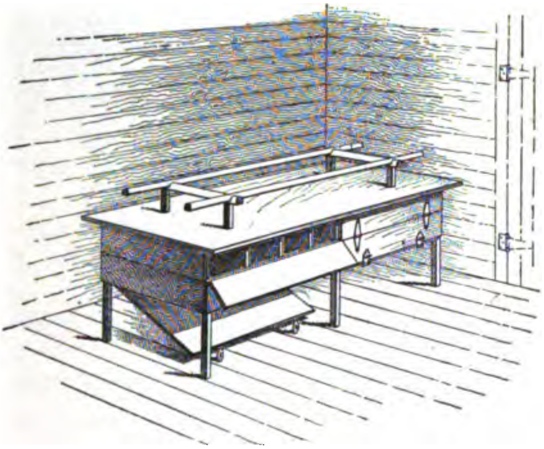


FIG. 5

14. Hinged Dropping-Board.—The **hinged platform** for catching the droppings is fastened either to the wall or to the studding or to a strip fastened in the wall. The platform *a* shown in Fig. 6 is fastened to the piece of 2″ × 4″ scantling *b*, which is set free from the wall and nailed to the studding; the platform is supported by legs *c* that are fastened with hinges *d* to the under side of the board. After the board has been cleaned, it can be turned up and fastened against the wall during the day and lowered into place at night. The hinged legs *c* close against the board when it is elevated and drop into place when it is lowered. A dropping-board like this hangs free if fastened to the studding, and will not need a strip to keep it away from the wall. Similar boards may be suspended from the roof by hooks that fasten into staples in the side of the boards, which may be slightly lowered when being cleaned. A platform and roost that has a cross section like that shown in Fig. 7 is convenient in small houses, in open sheds, or wherever a few fowls are kept; it is very light in weight and can be moved about or taken outside for cleaning. The platform should be 20 inches wide and should be placed 8 inches below the roost and 20 inches above the floor, unless it is to be used by fowls of the Asiatic varieties, in which case it should not be more than 18 inches from the floor.

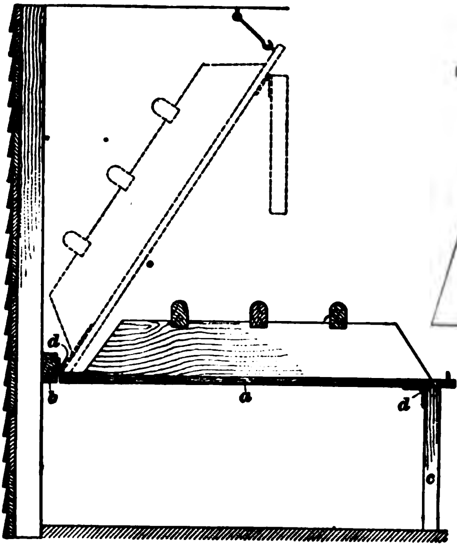


Fig. 6

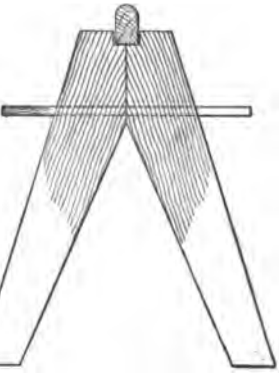


Fig. 7

ROOSTS

15. Location.—Roosting places are the night abodes of fowls and many other kinds of birds. The jungle fowls that were the ancestors of our domestic fowls sought high roosting places near the tops of trees; they did this to avoid their natural enemies that sought food at night. The domestic fowls of the present day have been taught to seek the shelter of houses as their sleeping quarters. Domestication has forced them into unnatural surroundings, but even at the present time they show their natural instinct by endeavoring to reach positions on the highest roosting places. For this reason roosts should all be on a level, not one above the other, and ample roosting space should be provided for the proper accommodation of each fowl, thus avoiding the necessity of crowding or pushing one another from the roost. A Bantam requires 6 inches of roosting space; a Leghorn, 9 inches; and a Brahma or Cochin, from 10 inches to 12 inches. The roosting pole, or perch, should be rounded on top, from 2 inches to 2½ inches wide, and from 3 inches to 4 inches high. It should be strong enough to be unyielding and firm beneath the weight of the fowls, and so made that it may be removed readily for cleaning.

16. Open Roosts.—The term **open roost** is applied to dropping-boards and roosts placed away from the walls of the building but so located that the roosting fowls will be protected as far as possible from cold drafts and changeable weather. An open roost with the ends closed may be built in the middle of the house through its entire length like a swinging shelf. This suspended roost should be open on the sides and hung high enough above the floor to permit the fowls to pass under it. When this kind of a roosting place is used in winter for laying hens, during very cold weather, a burlap curtain can be let down from the top to within 10 inches of the dropping-board. The roosts or perches for Asiatic fowls should be close to the floor. If the platform beneath the roost is 15 or 18 inches above the floor, it will be high enough for them. Platforms may be 1 foot higher for medium-sized fowls. The Mediterranean fowls can fly to and from high roosts, but the heavy-bodied kinds cannot fly to the elevated perches, and are almost certain to be injured when descending from them.

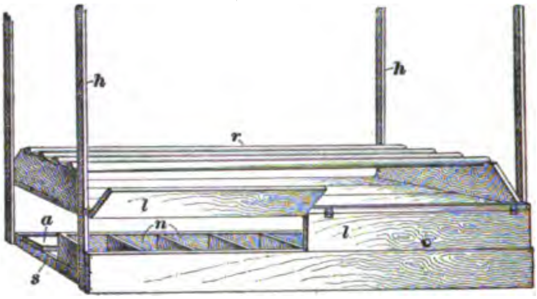


Fig. 8

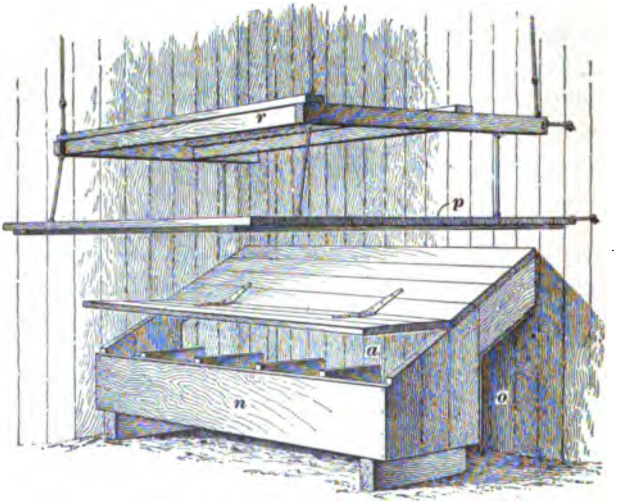


Fig. 9

17. Hanging Roosts.—Roosts, platforms, and nests may all be suspended from the roof of a poultry house. When made in this way, they are known as **hanging roosts** and should hang free and clear and be placed near the rear of the house. The roosting place illustrated in Fig. 8 hangs from the roof of the house by hangers *h*; the nest boxes *n* are 6 inches beneath the dropping-board and roosts *r* and rest on slats *s*. The board *a* in the rear of the nests is 12 inches wide and is placed there for the hens to fly on to when they are going to the nests. There are four roost poles and eight nest boxes; the lids *l* close the nests in front. An open roost may be too much exposed for a cold climate; it can, however, be enclosed during cold weather by covering the front and both ends with cotton duck, leaving the rear open for the access of the fowls and for air.

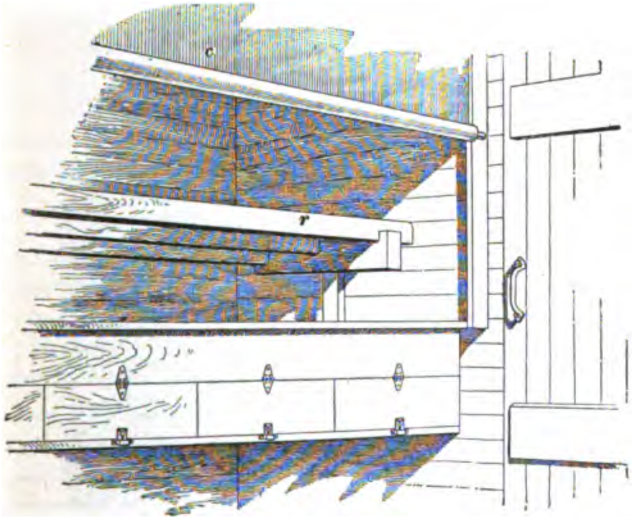


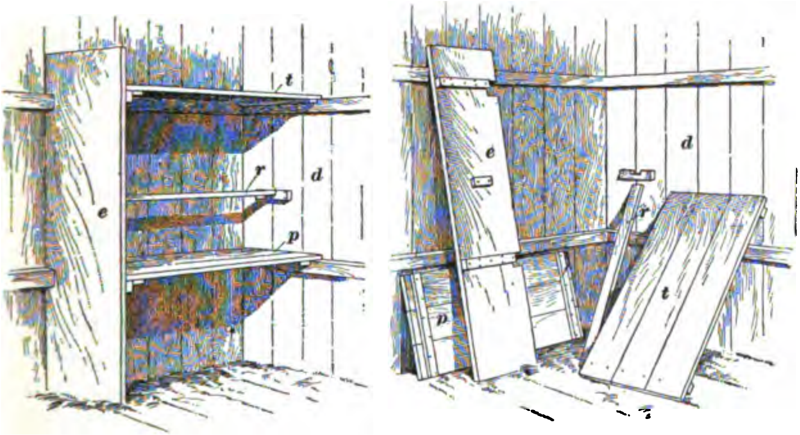
Fig. 10

The roost *r* shown in Fig. 9 is hung from the roof with iron rods. This style of roost can be built in any part of the house, preferably in the rear, and should hang free from the walls. The platform *p* is held in place by iron rods. This kind of roost can be taken apart and removed from the house for cleaning. The nests *n* below the roosts are portable and can be placed against the side walls in any convenient part of the house. The hens enter the nests from the rear passageway *o* and the eggs are gathered through the opening *a*. The nests are hidden and offer little temptation for the hens to eat the eggs.

18. Hooded Roosts.—Roosting places that are provided with curtains and that are built into or against the corners of walls of poultry houses are known as **hooded roosts** and such roosts have been considered undesirable because they are difficult to clean. If the roosts are properly made, these objectionable features do not exist. When it is desirable to use them, movable types should be installed. The corner roosting place shown in Fig. 10 is partly movable, the roosts *r* being let into movable uprights, but the board beneath the roosts and the nests is stationary. The curtain *c* hung over the top and front of this roost makes it suitable for very cold districts. Placing the nests on a shelf as described in *Poultry Houses*, Part 1, in the house for general use, changes the stationary nests into movable ones.

19. A roost built into the wall of the house is the best one to protect the fowls from cold. This roost may be a box or a shelf that is from 2 feet to 2½ feet high with an opening in front, as shown in Fig. 32. The shelf forms the dropping-board. The front can be closed at night with a cloth curtain stretched on a frame that fits into the opening, leaving several inches of ventilating space at the top of the frame. Where a large number of fowls roost in such an enclosure, the ventilating space must of necessity be larger than for a few fowls. The curtain keeps out the cold and retains the natural heat of the fowls, and at the same time the opening at the top furnishes sufficient ventilation. When a roost of this kind has direct connection with the interior of the room or loft overhead, the ventilation of the roost should be accomplished by openings into the house through the roof of the roosting place. If properly constructed and carefully ventilated, such a roosting place will protect poultry during severe weather, no matter how cold the nights may be. Although the term hooded roost is usually applied to roosting places that are enclosed overhead and in front with muslin or cloth, all kinds of enclosed roosts are at times spoken of as hooded roosts.

The curtain over the roosts should never fit so closely as to prevent free circulation of air. Window shades on spring rollers attached to the bottom of the roost opening can be drawn toward the top of the opening and fastened at the right place to permit good ventilation. If the shade rolls from the top and is pulled down, it prevents free circulation of the air, thereby possibly causing suffocation of the fowls. A muslin curtain perforated with ½-inch circular holes may be dropped from the top down over the opening, provided fully one-fourth of the entire curtain is open work. Such a curtain may be tacked to the top of the roosting place, and may be loosely dropped over the front at night during cold weather.



(a) (b)

Fig. 11

20. In Fig. 11 (*a*) is shown a **shelf roost** in which the end board *e*, overhead board *t*, roost *r*, and dropping-board *p* are all detachable; *d* is the stationary partition. The parts detached are shown in view (*b*). This roost is one of the warmest, if not the warmest, kind of roosting places. By its use, hens may be kept warm in the coldest localities as the heat from the fowls warms the air inside the roost box. No curtain should be used, as the fowls might be suffocated.

NEST BOXES

21. Enough nests should be provided to accommodate without crowding all the hens that want to lay at once. A hen usually goes to the same nest each time she lays, and the nests should be large enough to accommodate two or more hens at the same time. If the nests are not large enough for more than one, the hens may fight for the possession of the nest and in so doing break the eggs in the nest. The nests should be large enough to be comfortable for the hens, and so constructed as to permit the hens to enter them easily both from the floor and from other nests. If they are too small the hens will be restless and may break the eggs while laying. If the nests are filthy, the eggs will become soiled. If the nests are roomy, attractive, and clean they form a safe place for the hen to deposit her eggs. If permitted to choose for herself the hen will always select a dark or secluded nest both for laying and sitting; to favor this instinct it is always well that the nests be sheltered and darkened. If favorable conditions are lacking, disappointments will come from the loss of many eggs.

The nest boxes for Asiatic and other large hens must be at least 14 inches square and set low or close to the ground, as shown in Fig. 9; if they are 16 inches square they will not be too large. The nests for these fowls must be so constructed as to avoid the danger of having the eggs dragged from the nest by the feathers on the feet of the hens; the nests should never be so deep that hens will break the eggs when jumping into the box, nor so far from the floor that it will be difficult for the hens to get into them. For medium-weight fowls like Plymouth Rocks and Wyandottes, nest boxes at least 12 inches square should be provided. If they are 12 inches wide and 14 inches long, they will better accommodate these fowls. These nests should be elevated about 16 or 18 inches above the floor. The nests for Mediterranean and other light-weight fowls can be elevated to any reasonable height, as shown in several illustrations. Nests for the smaller fowls should be at least 12 inches square. Any box of the proper size and suitable for the purpose can be used for a nest. A square box of about the right size nailed against the wall beneath the dropping-board or behind a shelter makes a good nest.

22. Shelf Nest.—The nesting place shown in Fig. 12 is known as a **shelf nest;** the platform or cover *p* above the nests is a dropping-board; the nest box *n* fits into the space below, and the door *d* through which the eggs are gathered, opens outwards. The hens fly on the board *c* when going to the nest, and enter it from the rear through the opening *a*.

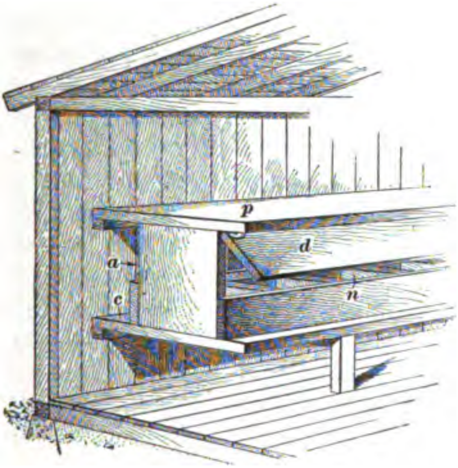


FIG. 12

The shelf nests are generally used for the Mediterranean and other light-weight fowls, and should be built up from the floor, serving the double purpose of saving room and preventing to a certain extent the formation of the egg-breaking and egg-eating habits of some hens, as these nests are not sufficiently enticing to attract the hens except when nature prompts them to lay, and they will leave the nests immediately after laying. This same kind of nest can be used for larger fowls, but when used for them must be built close to the floor.

23. Safety Nests.—There are several kinds of **safety nests** designed to prevent the hens from eating their eggs. These nests are not always necessary, as they have been largely superseded by trap nests, which serve the double purpose of record keeping and protecting the eggs from the hens. Sometimes, however, the hen on the nest eats her own egg; in this case a safety nest is the only protection. In Fig. 13 is illustrated one form of a safety nest. It consists of a frame that fits in a square box and the essential parts of which are two slanting boards, which are padded and covered with muslin or some other kind of cloth. The upper board extends two-thirds of the way across the box and the lower board slants in the opposite direction; when the egg is laid it rolls down these inclines to the bottom of the box. When a hen lays in a box of this kind, the egg rolls out of sight and away from the reach of the hen. The boxes into which the frames are made to fit should be 14 inches square and sufficiently deep to form a double nest. The frame is lifted out of the box when the eggs are gathered.

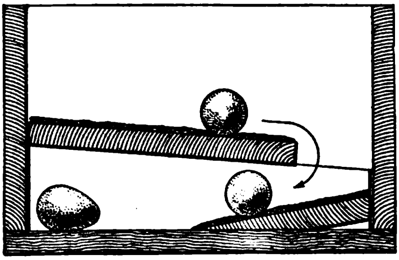


Fig. 13

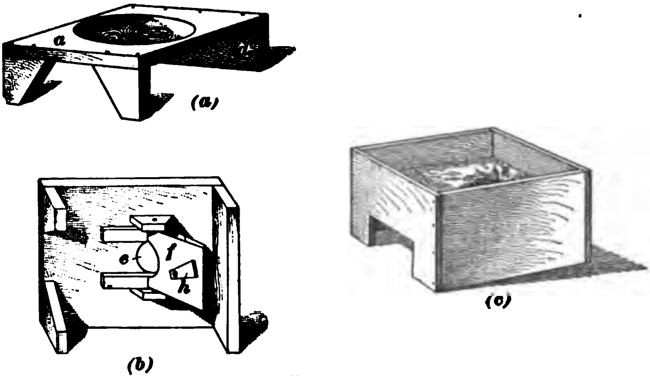
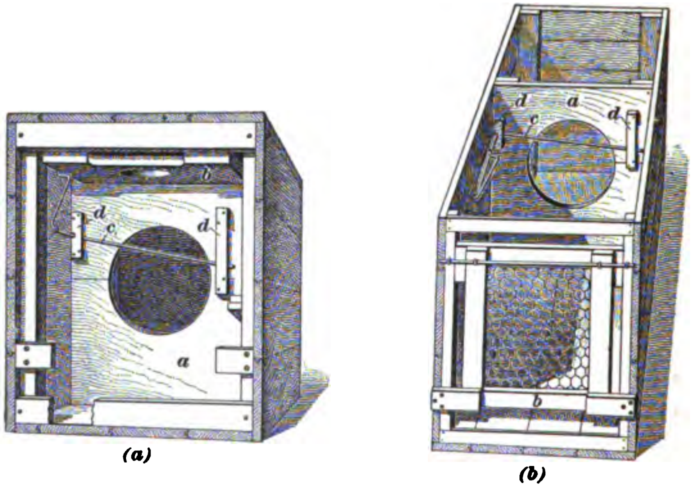


Fig. 14

A more elaborate safety nest is shown in Fig. 14; in (*a*) is seen the upper side of the bottom board; in (*b*), the under side; and in (*c*), the complete nest. The bottom board *a* is 1 inch thick, 12 inches wide, and 14 inches long; a board *d* 1 inch thick, 4 inches wide, and 12 inches long is nailed underneath and across one end, and at two corners are small blocks that serve as legs. The top of the board *a* is hollowed and has a hole near the rear of the depression. On the under side of the board is the trap *e* and the balance board *f*, through which is an axle of round wire. When the egg is laid it passes through the hole in the board and rolls along the balance board *f* into the nest below. The drop of the balance board is regulated by the button *h*. If the eggs are small, the button is moved to the left; if the eggs are medium sized or large, the button is moved to the right. The drop is light in weight and beveled like a shingle. The lower nest into which the eggs drop is padded with cotton flannel, and the eggs are removed through the opening in the front of the box. The egg-eating habit of hens can be overcome by having the nests properly made, roomy, and sheltered from their constant sight.

24. Trap Nest.—The egg-producing capacity of hens is ascertained by the use of **trap nests**; in no other way can the egg record of a hen be known to a certainty. When the hen enters a trap nest the door closes behind her, confining her to the nest and excluding other hens. After laying, she goes forward toward the light, where she must remain until released. Her identity is established by the number stamped into a metal band fastened around her shank. Only one hen at a time can occupy the nest; and when she is released the egg is removed and the trap reset for another hen. This prevents the egg from being broken and the possibility of the eating of the eggs unless the hen eats her own egg while on the nest. There should be one trap nest for each four or five hens; but fewer nests will answer, if they are visited frequently by the attendant. The trap nest may be placed on the floor, or may be slightly elevated above the floor, or it may be set on a box or a shelf. If any considerable number of trap nests are used they should be placed on a platform or shelf with the outlet convenient for the speedy release of the hens. The traps should be visited often, until the average daily egg yield has been gathered.

A good trap nest must possess a door that will close behind the hen when she enters the nest. It must also allow her to move forward to another part of the trap after laying the egg. Any box trap that will meet these requirements will answer the purpose.

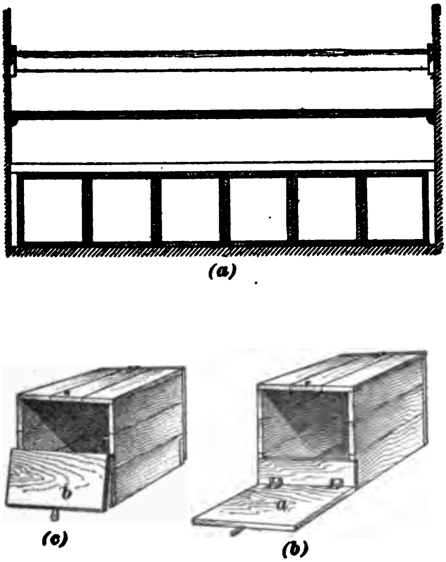


(a)

(b)

FIG. 15

25. Experiment-Station Trap Nest.—In Fig. 15 is shown the **experiment-station nest,** the use of which has been donated to the public by the Maine Experiment Station. View (*a*) shows the trap with a wooden door set ready for use; view (*b*) gives a general view of the interior and shows a wire-screen door. The box is 28 inches long, 13 inches wide, and 16 inches deep, inside measurements. A division board *a* with a circular opening 6 inches in diameter is placed across the box 12 inches from the back and 15 inches from the front end. The lower edge of the 6-inch opening in the division board comes to within 4 inches of the floor of the box. The rear section of the box forms the nest proper. The door *b* may be made of ⅞-inch pine boards, as shown in (*a*), or of poultry wire stretched on a frame, as shown in (*b*). The door does not fill the entire front of the box, a space of 1 inch being left on each side and a space of 2 inches at the bottom. If the door is of wood it has a hole 2½ inches in diameter bored near the center to admit more light, and a section is cut out of the upper end for the same purpose, leaving enough of the board at each side to extend to the crosspiece and hold the hinges. These may be made of leather and should be fastened to the inside of the door and to the crosspiece at the top.



(a)

(c) (b)

Fig. 16

A trip latch *c* is made of a piece of stiff wire about $\frac{3}{16}$ of an inch in diameter and 23 inches long. The wire is shaped so that a section 12 inches long rests horizontally across the circular opening in the division board, leaving about two-thirds of the 6-inch opening below it. The trip latch is held in place by two clamps *d*, one on each side of the circular opening. The clamps have slots large enough to allow the lower end of the wire to work up and down about 3 inches, without friction. The next section of the wire is 8 inches long and is bent to a right angle with the 12-inch section. The wire is fastened strongly to the wall of the box by staple and clamp, but so loosely that it can roll easily when the section that crosses the round opening is pushed up by the hen. The remaining section of the wire, which is 3 inches long, is bent so that it supports the door when opened, a notch into which the door slips being formed at the end of the wire. The notch prevents this section of the wire from sagging under the weight of the door and interfering with the free action of the latch. The wire from which the latch is made must be of good stiff material so it will not bend or spring much.

26. General-Purpose Nest.—The nest box shown in Fig. 16 is movable and may be called a **general-purpose nest.** It may be used alone or a number of nests can be placed together on a shelf. The general-purpose nest is a good one for sitting hens as well as for those that lay. This nest box is 12 inches wide, 14 inches high, and 16 inches long; the door *a* shown in (*b*) is in the rear, and when open forms a platform on which the hen alights when entering the nest; the front door *b* shown in (*c*) covers half the end, and the eggs are gathered through it. If nests like these are used for sitting hens, the rear door *a* can be exchanged for a frame covered with screen wire to admit air and light. Nests of this kind should be placed beneath the dropping-board and roosts, where they can be easily removed for cleaning. Several nests on a platform underneath a dropping-board are shown in (*a*).

27. Nesting Material.—Soft, pliable, clean material must be used for nests. A layer of dry earth or sand about an inch deep is put in the nest box, and this should then be covered with 3 or 4 inches of hay or straw the fiber of which has been broken. In this material a round nesting place can be shaped. Fine meadow hay, oat straw, wheat straw, or chaff should be selected for nesting material in the order named. Any kind of soft material or leaves will answer the purpose if hay or straw cannot be obtained. Sand from which the gravel has been removed with a sieve, sawdust, or fine shavings are all good nesting materials for warm weather; these should be stirred up with the hands and shaped into form every time the eggs are gathered. Straw nests should be stirred up and shaped once or twice a week.

28. **Care of Nests.**—Through **cleanliness** and **watchfulness** the nests may be prevented from becoming soiled with broken eggs and excrement. The nesting material should be changed often enough to keep the nests fresh and clean. All possibility of the harboring of insect vermin within the nest boxes should be obviated by frequently painting both the interior and the exterior of the boxes with some kind of liquid lice killer. Insect powder of some kind should be dusted frequently into the nesting material. Nothing is better for this purpose than pyrethrum, which is better known as Persian insect powder. The use of this powder during the summer months will reduce the number of vermin. Clean nesting material assures clean-looking eggs.

UTENSILS FOR FEEDING

29. **Sanitary Conditions.**—No grain or other feed should ever be thrown on tainted ground or on floors that are polluted or otherwise unfitted as feeding places for fowls. If this precaution is not taken, disease may be contracted by the fowls when eating; it is equally dangerous to place feed for fowls in boxes or troughs that are unsanitary. Milk fed about the runways befouls whatever it touches, and grounds so polluted become hotbeds in which disease germs propagate. Nothing is more dangerous to poultry than tainted soil; germs that bring the gapes, liver diseases, and other ailments will grow in it. Feeding places must be sanitary in order to avoid these diseases.

30. **Feed Troughs.**—The value of clean, wholesome **feed troughs** is due to the fact that they afford places where fowls may eat without danger of contracting diseases. When mash

is fed, a trough of some kind must be used. Troughs should not be used, however, except when necessary, as the fowls often eat too quickly from them, grabbing the choice grains and gorging themselves in their eagerness to secure the best. By scattering grain on clean soil in the runways the double purpose of feeding and of exercising the fowls is served.

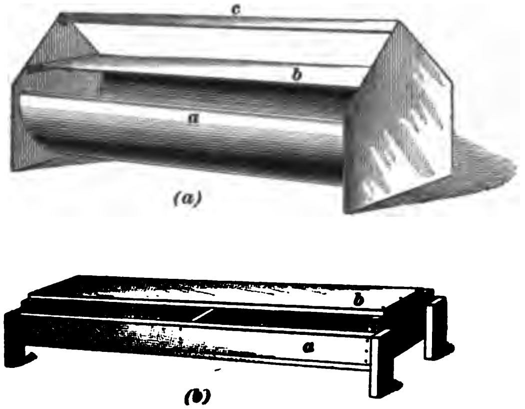


FIG. 17

Troughs or boxes used as feeding places should be so arranged that the fowls are prevented from walking over the grain or from scratching in the mash. A shelter board can be placed over the feed, as shown in Fig. 17 (*a*) and (*b*). The trough *a* may be V-shaped, flat, or round; in any case, the shelter board *b* permits the fowls to feed from the trough, but prevents them from wasting or befouling the food; the strip *c* in (*a*) strengthens the trough and can also be used as a handle by which to move the trough about. Tin cans can be so cut that they are useful for feed and water vessels; one of these vessels is shown in

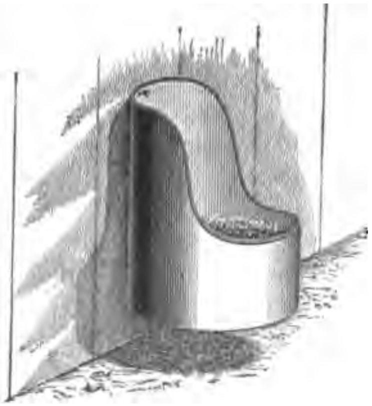


FIG. 18

Fig. 18. In making tin vessels the edges must be smoothed with a file to remove the danger of injury from sharp points. Cans hung about the poultry yards and filled with feed, water, and grit make stations from which the fowls may help themselves.

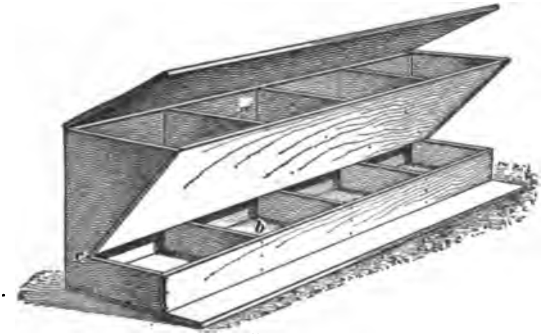


FIG. 19

31. Automatic Feed Hoppers.—For keeping the food constantly before the fowls in the same way that cage birds are fed, **automatic feed hoppers** are used. These hoppers may hold only one day's rations, or they may be large enough to hold a supply for several days. The grain is put into the box from the top and goes down and out into the feed trough. A single, or one-sided, hopper is shown in Fig. 19, and a double, or two-sided, hopper is shown in Fig. 20. The grain runs from the hopper into the trough *b* as fast as the level of the grain in the trough is lowered below the line *c*, and will continue as long as there is any grain in the hopper. The hopper in Fig. 19 is shown as having four separate boxes, one for wheat, one for cracked corn, and the other two for grit and shell. All boxes can be used for grain and another or smaller hopper be used for grit and shell. Fowls, both old and young, help themselves from automatic feed hoppers;

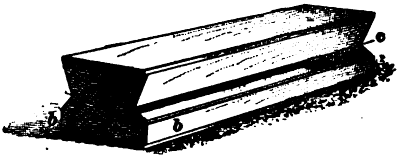


FIG. 20

this method is called hopper feeding and is practiced by some poultrymen for all kinds of fowls. Automatic feed hoppers are most frequently used, however, for feeding young chicks and market poultry.

32. A large automatic feed hopper that holds 2 bushels of grain is shown in Fig. 21. It can be made from a shoe box 3 feet long, 18 inches wide, and 14 inches deep. It is set on end, and has a lid on top and a double bottom, which elevates it above the floor and prevents the grain from being mixed with the dirt and wasted. This hopper is used mostly for feeding wheat screenings to laying hens that have the freedom of the fields, and such a large box is useful only when a large number of fowls are to be hopper-fed. A box like this should be filled only when it is necessary. The interior may be divided as shown in Fig. 19.

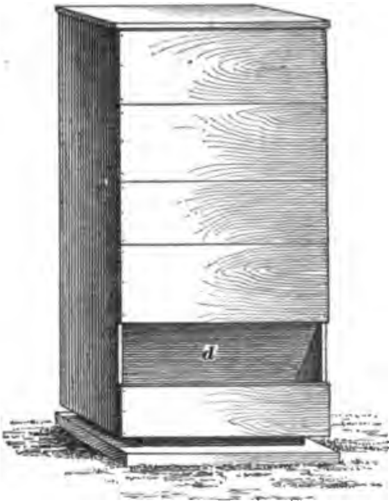


FIG. 21

33. Feed hoppers and water vessels made of galvanized iron last much longer than those made of wood or tin, and although the first cost of the galvanized-iron vessels is greater than that of wooden or tin vessels, the former are cheaper, length of endurance considered. The Cornell feed hopper, which is made of No. 26 galvanized iron, is shown in Fig. 22. This hopper is 36 inches long, 24 inches high in the rear, 19 inches high in front, and 8 inches deep. In the front are eight openings *d* 2½ inches wide and 6 inches high, through which the fowls obtain their food. The door in front turns down, and when closed it makes the hopper rat-proof. There is little waste by the use of the Cornell hopper, and it may be divided into three or more compartments for different feeds or may have but one compartment. When the hopper is in use it should stand on a board platform that elevates the bottom of the box 6 or 7 inches above the floor. The platform must be large enough to permit several hens to stand on it.

34. A **grit box** of some kind should be used in or about all poultry houses and runways and should be kept filled constantly. In Fig. 23 is shown a small hopper for grit and shell, which may be made of the same material as the Cornell hopper and after the same general plan. This hopper is 18 inches long, 12 to 14 inches high, and 4 inches deep, and is divided into three compartments. It is small, light in weight, and can be filled with grit, shell, and charcoal, and hung against the wall.

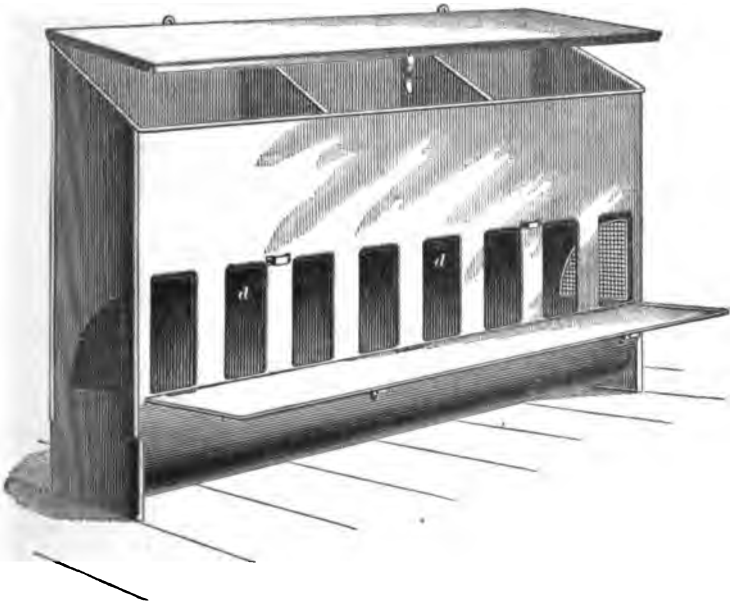


FIG. 22

DRINKING VESSELS

35. Selection and Care of Water Vessels.—Fowls can neither retain their health nor lay well without a plentiful supply of pure, fresh **water,** and for these reasons the sanitary condition of drinking vessels should be perfect. A vessel of almost any kind that is easily cleaned may be used as a receptacle for the daily water supply of the fowls. A vessel that cannot be thoroughly cleansed and protected from filth should never be used. All drinking vessels should be elevated from the ground or floor to avoid the formation in them of an accumulation of filth and dirt caused by the scratching of the fowls. Filth and slime gather quickly in water vessels that are in constant use or exposed to the sun, thus producing disease germs, which spread rapidly throughout the water and which cause among the fowls ailments that are readily transmitted. Almost two-thirds of an egg is water; if the water supply is foul and unwholesome, it will taint the flavor of the egg. If the water is pure and fresh, there will be increased consumption, while unsanitary conditions reduce it.

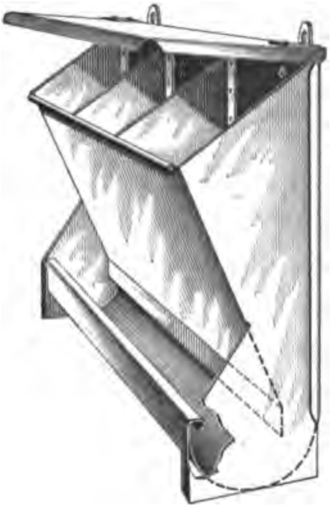


FIG. 23

While a plain iron kettle will serve as a drinking vessel for the hens it is better to use a porcelain-lined kettle, as it can be more readily cleaned. The kettle may be suspended from a wire so that it will be just high enough above the ground or floor to permit the hens to drink without standing on the rim of the kettle. The kettle may also be placed on a platform from 20 to 24 inches square, through which a hole large enough to set the kettle in has been cut. The platform should be made so that the rim of the kettle will be at least 3 inches above the floor of the platform. The kettle should taper from top to bottom and should be not less than 6 inches deep. A tapering crock of the proper size will answer well as a substitute for the iron kettle. The crock may be set into the same opening in the platform, but during cold weather the iron kettle is better, because the freezing of the water will not break it, and the ice can be broken and removed from the kettle without injuring it. The platform should stand not less than 9 inches from the floor.

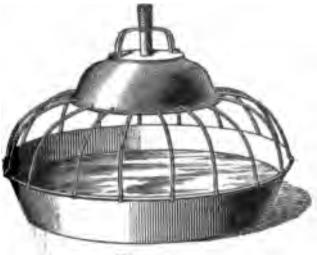


Fig. 24

Iron kettles, porcelain-lined kettles or pans, buckets or pans made of galvanized iron, crocks, and tin pans can all be used for drinking vessels, but in choosing them, due consideration must be given not only to cleanliness and sanitation but also to the durability of the different kinds of vessels. There are many ways to avoid undesirable accumulations in water pans, but all require care and cleanliness on the part of the attendant.

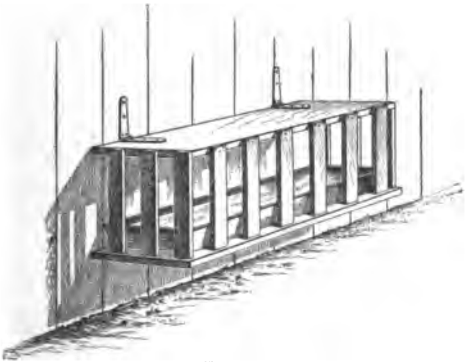


Fig. 25

36. Water-Pan Protectors.—In Fig. 24 is shown a galvanized-iron drinking pan that prevents the fowls or growing chicks from walking in the water. When in use, this pan should be placed on a box or otherwise elevated in order to keep it clean. In Fig. 25 is shown a fruit crate hung against a fence and inside of it an iron bread pan, which is filled with water. The fowls must reach between the slats to drink from the pan. In selecting the crate, one should be chosen in which the slats have openings of the proper width to permit the entrance of the heads of the fowls. The water-pan protectors shown in Figs. 26 and 27 can be quickly made from small boards and slats. One has a hinged lid through which the pan is removed; the other is merely a frame covered with slats, which may be set over the water pan. This device may be used in runways, yards, or fields, or wherever a supply of fresh, clean water is desired for the hens. Any one of the simple devices shown will protect the health of the fowls in many ways.

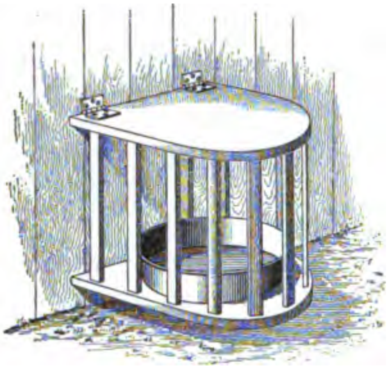


Fig. 26

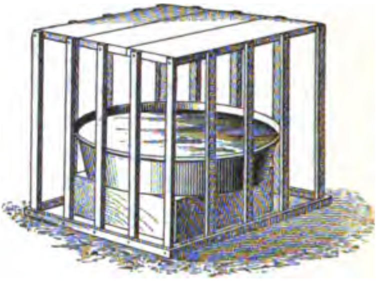


Fig 27

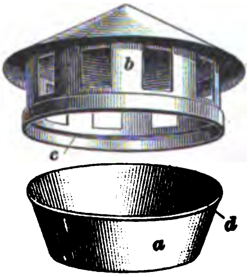


Fig. 28

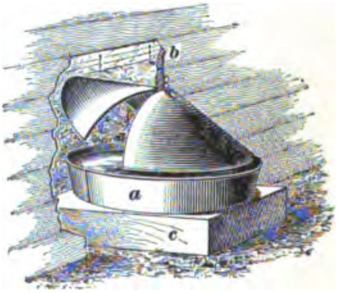


Fig. 29

37. In Fig. 28 is shown a water pan and cover made of No. 26 galvanized iron. The pan *a* is 15 inches across the top, 12 inches across the bottom, and 4 inches deep. Inside of the cover *b* is a wire rim *c* that rests on the wire rim *d* of the pan when the cover is closed. The fowls reach through the openings in the side of the cover into the pan to drink; these openings are 2½ inches wide and 4 inches high. The pan should be placed on a platform, which should be large enough for the fowls to stand on when drinking.

38. When a number of fowls are housed in separate pens, the labor of watering them can be reduced by using a protected pan that will furnish water for two pens. With the drinking pan located as shown in Fig. 29, it is possible to serve two lots of hens from the same dish. The water pan *a* is set in the partition *b* and elevated on the platform *c*; hinged hoods over the water pan prevent the fowls from walking in the pan, and the shape of the hoods, or covers, prevents the fowls from standing on them. The rim of the cover should not come so close to the pan that it will prevent the fowls from drinking; they should be able to reach their beaks into the water near the outer edge of the pan. This pan and cover is also made of No. 26 galvanized iron, and the joints are well riveted and soldered to make them strong.

DUST BOXES

39. Importance of Dust Bath.—Fowls will roll and wallow in dry dust to clean themselves and to free their bodies and plumage from insects, and for these reasons the dust box may be looked upon as a bath tub for the hens. If fowls cannot run at large and wallow in the earth, the dust box is an absolute necessity. When the hen rolls in the dust fine particles of it pass through her feathers and destroy the clinging body lice, thereby greatly relieving the fowl. If deprived of the dust bath, the confined hen has no chance to free herself from these pests. The boxes provided for the dust bath should be placed where the rays of the sun will fall upon them about noonday, as that is the favorite hour for the hen to take her bath. The boxes should be deep enough to prevent the light material from being spilled. They should be strongly made of wood and should be painted both inside and outside with hot tar or iron paint. The coating of tar or paint prevents the destruction of the boxes by the sun and rain.

40. Open Dust Bath.—Open dusting places can be made in the corner of the poultry house by placing a board across the corner and filling the enclosed space with dry earth, or the entire floor may be covered with earth in which the hens can wallow at will. If the earth is very dry, dust will be raised when the hens wallow in the bath. This dust may enter every crack and crevice in the house and thus drive away the lice, but at the same time, everything within the house becomes covered with dust and dirt, which is a disadvantage.

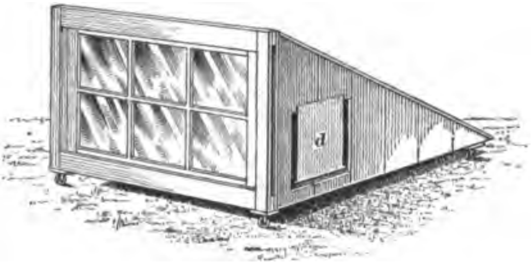


Fig. 30

41. Enclosed Dust Bath.—A box that is useful for a dust bath and that confines the dirt and is always ready for service, can be made as shown in Fig. 30. The size of the box depends on the size of the poultry house where it is to be used. The box shown in the illustration is 3 feet square on the floor line, and 2 feet high in front, and can be made either of galvanized iron or of wood. The sash in front fits tightly, and the fowls enter the box through the small door *d*. This door is formed of a burlap curtain cut a little narrower than the opening over which it hangs. The curtain is fastened tightly to the top and a small iron rod is worked into the curtain at its lower edge, thereby spreading the curtain and holding it down. The curtain swings as the fowls push against it in entering and in leaving the box. A box of this kind, if placed on casters, can be rolled about and the glass kept in the sunlight; the sun warms the earth in the box and dries it for the dust bath. Where this box is used the fowls can wallow in the dirt, and little dust or dirt will come out of the box.

42. Combination Box.—For a few fowls that are kept in limited space, the combination box is of value. This box, which is a most cleanly contrivance, combines so many necessary features that it is not only a labor-saving device

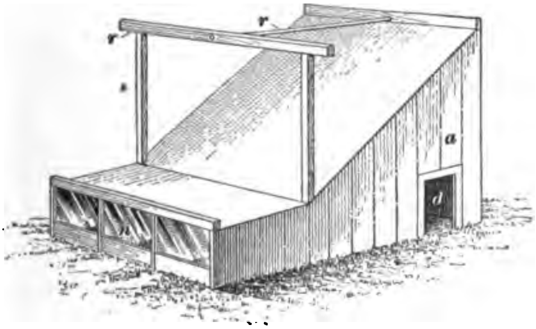


Fig. 31

but is also a space saver. A box of this kind made of lumber is shown in Fig. 31; the floor and top of the box are made of flooring dressed on both sides, the remaining portions of the box except the roosts and roost supports, which are 2 inches square, are made of ½-inch lumber. All the lumber used is dressed on both sides, and the joints filled with white lead; and the box is painted both inside and outside with hot tar or iron paint.

The main part of this dust box is made like the one shown in Fig. 30. It is 36 inches square on the floor line, it is 18 inches high in front; the interior of the dust box is 3 feet long and 2 feet wide. The nest boxes *n* are 12 inches square and 10 inches high. The top of this box forms the dropping-board; the door *d* is arranged like the door in the enclosed dust box; and the front consists of a glass window that slides in a frame. Narrow boards are set upright inside of the dust box to prevent the dust and dirt from working out through the lower edge of the door or sash. This combination box has three nests, dust box, roosts, and dropping-board, and will accommodate nine hens. Like the enclosed dust box it may be made of galvanized iron and many boxes of this type have casters beneath them for quick moving.

43. Material for Dust Bath.—Although many birds love to roll and wallow in the dirt, they do not always select dry earth for this purpose, but occasionally prefer it slightly moist. Dry earth is, however, more efficient in removing the lice, and for this reason it is well to have clean, dry material for the dust box. Any kind of earth will answer the purpose if it is fine and dry enough to find its way into the down of the feathers and to the skin of the fowls as they roll and wallow in it. Road dust or fine earth from which all other substances have been sifted, or either of these materials mixed with an equal amount of fine dust that can be sifted from coal ashes or land plaster, are good materials for the bath. Road dust should never be used without sifting all other dirt from it. A mixture made of equal parts of clean road dust, land plaster, and the fine dust from coal ashes, to which has been added a quart each of tobacco dust and slacked lime to each bushel of the mixture, provides a material for the dust bath that rivals insect powder in its efficiency; this mixture can be relied on to cleanse the bodies of the fowls and to free them from body lice. Wood ashes are not fit for use in the dust bath.

LOCATION AND CARE OF EQUIPMENT

44. Location.—The equipment of poultry houses should be so placed that all possible floor space will be reserved for the use of the fowls, and so that the time and labor of caring for them will be reduced to a minimum. These things may be accomplished by having the equipment located at the sides and ends of the house where it may be looked after without going over the same space a number of times. Fig. 32 illustrates how the equipment can be placed to avoid extra work in caring for the fowls and the house. The building rests on corners *a* built of stone laid in cement; the floor *b* is made of narrow flooring boards laid over a cement layer *c* and nailed tight to the floor joists. The doors *d* are double and swing both ways. The hoppers *h*, one for grain and the other for grit, shell, and charcoal, are on one side of the door, and on the other side are the nest boxes *j* and over these are coops *k* for confining extra male birds or broody hens. All of these appliances can be quickly and conveniently cared for.

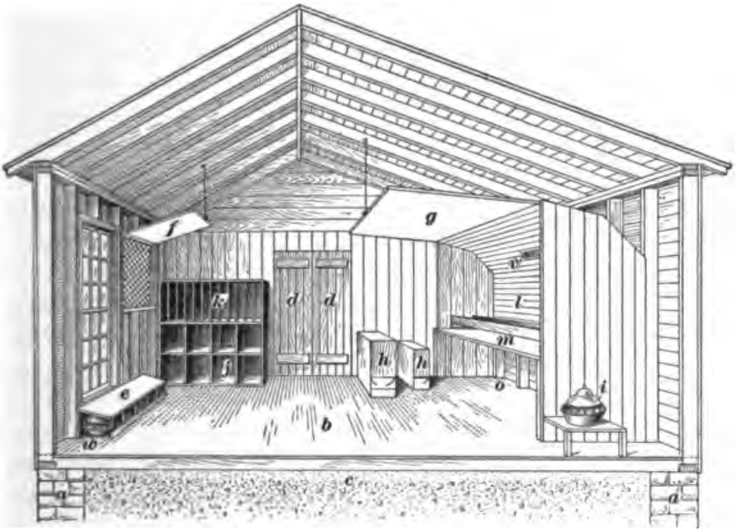


Fig. 32

The enclosed roosting place, or shelf roost *l*, at one side away from the doors and windows, provides protection without reducing the floor space because of the open space *o* beneath the dropping-board *m*. The roosts are enclosed at both ends, at the rear, and above, and a cloth curtain *g* can be turned down over the roosts when needed. The air circulates all around the outside of the roosting place and passes through the small opening *v* in the top of the roosting place. This assures ventilation and protection from the outside cold. Against the end of the roosting place is the covered water pan *i*; this pan is elevated above the floor level on a platform large enough for the hens to stand on when drinking. If preferred, a feed box *e* can be located under the glass window and the pan for water *w* placed in one end of the feed box. The curtain *f* is turned down over the open window when it is cold. All this equipment is plain and inexpensive and is located so that it can have attention with the least amount of labor. A dust box like that shown in Fig. 30 can be placed on the floor in front of the glass window during the winter, or kept there constantly if there is no outside dusting place for the fowls.

45. Care of Equipment.—Regular attention must be given to the care of all equipment. Water should not be allowed to freeze in the pans, nor to become contaminated with excrement or disease-spreading filth of any kind. Frozen vegetables or mash feed left in the trough until frozen, are liable to cause stomach trouble if they are eaten by the fowls; ptomaine poisoning can be contracted from meat or bones that are neglected until they become infested with maggots. Liver troubles and a disordered crop and stomach follow in the trail of neglect of feed and water troughs. A neglected roosting place will become a breeding spot of all kinds of disorders. The equipment and the floors of the house must be constantly cleaned and cared for in order to prevent failure caused by unsanitary surroundings.

POULTRY-HOUSE MANAGEMENT

GENERAL REMARKS

1. Essentials of Good Management.—In order to achieve the greatest success in any business, the management must be good. The prime essentials of good management in the poultry business are a thorough knowledge of the conditions under which fowls thrive and the maintenance of cleanliness and good sanitary conditions. There must be a good system of supervision, and close attention must be given to all the details of the care of fowls. Regularity in the feeding of the fowls, in the cleaning of the house, and in the gathering of the eggs is of great importance. A dozen hens kept in a small, well-managed house often prove far more profitable than twice that number in a badly managed house. Roup, ailments of the digestive tract, and other diseases are the direct results of poor care and improper management. Lice and mites, destructive insect pests, also flourish in neglected houses. Many valuable birds that could easily be protected are lost each year through the depredations of dogs, cats, foxes, hawks, and other animal marauders. Through the selection of the right type of house and by properly caring for it, loss from nearly all of these evils may be prevented.

2. Purpose of a Poultry House.—The wild ancestors of our domestic fowls selected their own shelter to meet the necessities of the season. Their descendants must accept the quarters provided for them by man. Fowls are not properly housed in a structure that simply protects them from outside dangers. They must be provided with quarters that

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not only protect them from outside dang[illegible] but from inside dangers as well. The house must be supplied with ai[illegible] that is free from noxious impurities, and the fowls must be protected from drafts and dampness at night while on the roosts. They must also have comfortable daytime quarters where they can be protected in inclement weather, which decreases their vitality and produces disease.

3. Selection of a House.—The house selected for poultry should be the one best adapted to the purpose for which it is intended. A house suitable for a town lot will not answer for the farm, nor will the one best suited to the farm be the one needed for a small flock. A house with more room in it than is necessary to accommodate the fowls is a waste of space and material, and increases the labor of caring for the house. Houses should not be selected for appearance alone, nor because a certain style of house is generally used in a locality. It is better to have conveniences, together with comfortable quarters, than to sacrifice them to beauty of structure; at the same time, architectural beauty need not be wholly disregarded.

A low, tightly built house can be successfully managed during the coldest weather; but, on the other hand, this kind of house will be excessively warm at night during hot weather. Because of this fact, the house with an overhead loft, which tends to make the house temperature uniform, is more suitable to a changeable climate. Such a house can have a ceiling just high enough to permit the attendants to care for the house and fowls without inconvenience. Houses of this kind are suitable for the farm where a considerable number of fowls are kept in large flocks that are not confined during the day.

4. Advantages of Wide Houses.—In addition to the advantages mentioned in *Poultry Houses*, Part 1, a **wide house** has the further advantage that the roosts for the fowls can be placed farther from the windows than is possible in the narrow house. The farther away the roosts are from the windows, the less danger there will be from drafts, and, for this reason, more fowls can roost safely in a wide house and be better protected in it than in a narrow house. The combination house has this advantage to a considerable extent, as the fowls on its roosts are almost 16 feet from the front.

5. Space Requirements for Fowls.—Fowls require constant exercise to keep them in reasonable health, and when they are confined they must have sufficient scratching room to furnish this exercise. More space is required in the poultry house when the fowls are confined all or part of the time than when they have their freedom all the time. Fowls that run about in the open during the whole year do not need floor space inside the house for exercise. Those that are confined must each have from 4 to 5 square feet of floor space. The rule generally applied for live-stock is that 1 cubic foot of air space be allowed for each pound of live weight. Conforming to this rule, a house 10 feet long, 5 feet wide, and 1 foot high would be the proper size for ten hens weighing 5 pounds each. Working space must be provided for the attendant, however, or the houses cannot be cared for. When this space has been provided there is about 30 cubic feet of air space for each hen. This amount of space of course removes the possibility of the house being warmed by the heat from the bodies of the fowls.

When fowls are confined during winter weather, the floor of the house is their only place for exercise. Thirty hens in a house 12 feet square will have a space of 144 square feet to walk over. While this space gives about 5 square feet to each fowl, each one, of course, has nearly the full space for exercise.

6. Cleanliness.—In order that the birds may be kept healthy, it is necessary that the house, run, and equipment of the poultry plant be kept clean at all times. The dropping-boards should be cleaned daily whenever possible. The nests and floors also should be regularly and frequently cleaned and disinfected. The side walls and ceiling of the house must also be kept in a sanitary condition, and accumulations of dirt and manure should never be permitted within the house.

7. Pure Air.—The importance of having a good supply of **fresh air** was shown in *Poultry Houses*, Part 3. The proper management of ventilating appliances described there is essential for the health and well-being of poultry. The ventilators should be so managed that the fowls are never exposed to direct drafts of cold or damp air. Poor ventilation is the source of many of the poultryman's troubles.

8. Care of Windows.—The glass in the windows should at all times be kept free from dirt so that there is no obstruction to prevent the sunshine from penetrating to the interior of the house. The use of shades or awnings at the windows is often an advantage, as they help to keep down the temperature inside the house during hot weather; they also lessen the severity of frigid temperature. Cloth windows must be kept free from dust so that the pores of the cloth will be open for the free circulation of air. If the pores of the cloth are obstructed or closed, the necessary circulation will be hindered or, perhaps, completely stopped.

POULTRY HOUSES

CARE OF THE INTERIOR

FLOORS

9. Dirt Floors.—Houses with **dirt floors** have some advantages that are not found in houses having cement or board floors. Direct contact with the ground makes a house warmer in winter and cooler in summer, and for this reason dirt floors should be used wherever they can be kept perfectly dry and sanitary. Clay floors that are tamped solid and smooth will become almost as hard as brick, thus making a good floor for poultry houses, provided rats, mice, and other destroying vermin can be kept out of the house. To keep them out of houses that have dirt floors, the floor should be covered with broken stones and coarse gravel, on top of which an inch or two of damp clay should be placed.

The surface should then be sprinkled until the clay is damp enough to pack. A dry, durable dirt floor will result from this treatment. If dropping-boards are used and the surface of the floor is covered with sand and cleaned frequently, the house can be kept in a sanitary condition. No floor is worse, however, than one of damp dirt contaminated with excrement and other filth.

10. Board Floors.—Unless the air circulates beneath them, **board floors** that are built close to the ground are damp. If the floor is elevated above the ground and open beneath for a free circulation of air, the floor will be cold and rats can be harbored beneath it. To eliminate these objectionable features, a filling of concrete should be packed between the floor joists, and all the sills of the house itself should rest on a cement foundation. A board floor in such a home will be rat-proof, but cold if no air circulates beneath. The coolness and dampness of floors may be overcome by the use of litter. Board floors must be scraped and swept to keep them clean; but if they are covered with dry litter, they are not only warmer but are also clean.

11. Cement Floors.—Although in many ways a **cement floor** is an ideal one for poultry houses, it is a cold floor. To overcome this objectionable feature, cement floors are covered with litter during the winter months. A deep covering of dry straw, which may be dried occasionally in the open air, is best for the purpose.

12. Litter.—The floors of all poultry houses should be covered with **litter** of some kind to keep them in good condition and to provide a scratching place for the fowls. They will scratch and dig for hours in search of small grain that is hidden in the litter, and by so doing obtain much beneficial exercise.

13. Earth Litter.—Earth is often used as litter; and a layer of this material from 4 to 6 inches thick spread over the floor gathers and absorbs moisture and counteracts to a considerable extent the injurious influence of the droppings.

When the earth has become damp or unsanitary it should be removed and used for fertilizer. A disadvantage of earth as a litter is that when it becomes perfectly dry the scratching of the hens will then cause clouds of dust to arise. For this reason earth is not recommended for houses that are to be kept fastidiously clean. As sand will not cause so much dust when stirred up, its use as litter is less objectionable than that of dry earth.

14. Straw Litter.—Perhaps the best litter is **dry straw,** because it readily absorbs moisture and is a very good scratching material. A floor covered with straw will usually be made bright and clean as the result of hours of scratching in the straw. If the straw remains perfectly dry, it gives evidence that good sanitary conditions exist within the house; if the straw becomes moist and heavy, it should serve as a reminder that the interior conditions are not what they should be, and that the straw should be removed, the building cleaned, fresh straw provided, and the cause of dampness removed. If the interior conditions are right, straw litter will continue to do service until worn out or broken into fine pieces. Wheat, oat, or rye straw are all good, but oat or wheat straw, on account of their relatively low cost, are generally used. Straw is easily cleaned when moved into the sunshine and can be put back into the house after the floor has been swept. Either whole or cut straw may be used for litter.

15. Leaf Litter.—In many localities where **leaves** are plentiful, they are gathered when dry and stored for use as litter during the winter months. One objection to leaves is that they must be renewed frequently because the scratching of the hens breaks them into small pieces. The leaf litter in a pen may be renewed either by adding to what is already on the floor, or by removing the worn out litter and supplying a fresh lot. Other objections to leaves are their tendency to adhere to excrement and to break into fine dust when dry.

ROOSTING PLACES

16. Fowls that roost in the limbs of trees select limbs that are about 2 inches or a little less in diameter. In poultry houses round poles are frequently used for roosts, but the most satisfactory ones are made of 2″×4″ scantling, the corners rounded and the scantling placed with either the wide or the narrow edge up, as preferred. Smaller roosts are sometimes made of pieces that are 2 inches square, or 2 inches thick and 3 inches wide on top, with the top corners rounded. For young chickens, boards 6 inches wide are often used for roosts. The board roosts are used to avoid crooked breast bones that develop in growing chickens that are forced to roost on small round poles. These flat roosts also serve as comfortable rests for heavy fowls.

17. Nothing is more detrimental to the health of poultry than the unsanitary conditions caused by the accumulation of excrement and other filth beneath the roosts. If roosts and dropping-boards are permitted to become foul and unsanitary, they soon become infested with vermin, and the odors that arise from the evaporation of the moisture in the filth are injurious to the health of fowls. Red mites, which are one of the worst poultry plagues, frequently gather in clusters on the under side of the roost poles. To prevent this, the roost poles should be cleaned frequently and coated all over with liquid lice killer, kerosene, or crude petroleum. If this thing is done every week there will not be much chance for the mites to be harbored about the roosts; but if they are neglected, the roosts will become infested with mites just as soon as the weather becomes warm. The roost is the sleeping place of the fowls—nearly one-half of their lives are spent thereon; and for humane reasons, if for no others, the roost poles should be clean and comfortable.

18. Dropping-Board.—The top of the **dropping-board** should be covered with enough dry sand, earth, or land plaster to prevent the droppings from adhering to the board. As often as the board becomes filthy it should be cleaned; where few fowls are kept, one or two cleanings a week will be enough, but if a large number of fowls are kept, the board should be cleaned daily. When it is not cleaned each day the droppings should be dusted over every day with dry earth or other absorbent material. Such materials should be kept in a covered box close to the roost for ready application. The board may be cleaned by sweeping or scraping the droppings into a box. The board should then be prepared for use again by covering it with sand or other protecting material. In addition to the frequent removal of the droppings the dropping-board should be thoroughly cleaned and sprayed with liquid lice destroyer, kerosene, or crude petroleum at least once in every 2 weeks in summer and every 4 weeks in winter. In this way a perfectly sanitary condition of the dropping-board may be maintained.

The fertilizing value of the droppings is unchanged by the application of dry earth or land plaster to the dropping-board. The dry earth or the plaster absorbs the moisture and neither lessons nor increases the value of the droppings. On the whole, dry earth is preferable because of its cheapness and because of the fact that the land plaster may not be needed on the land. The use of lime for covering the board is not recommended, for the reason that it decreases the fertilizer value of the droppings; lime also bleaches the yellow color of the shanks of the fowls, and the dust from lime injures their eyes. Lime, too, may be of no benefit to the land when applied as fertilizer with the droppings. The droppings should be kept under cover in order to keep them dry. In this way the gatherings of a whole year may be cared for and kept in perfect condition for returning to the land at the proper time. If the dry manure is passed through a crusher and reduced to a powder its value as a fertilizer will be increased.

NESTING PLACES

19. Nest Formation.—The hen, if she is left to follow her inclinations and has an opportunity to do so, will select for a nest a hole in the ground beneath a stump, a stone, or a bush, and into this she pushes dry grass, wisps of hay, or leaves. A nest of this kind inclines to the center, and the eggs will roll into it and not out of it. The lowest spot in a nest made on the ground is the coldest, and also the most likely to be moist. As the eggs accumulate, the hen turns and moves them each day, and thus those on the outside are worked toward the center of the nest. When making nests for hens, their natural instincts should be considered.

Moist earth is the natural foundation for nests, and in making them an inch or two of this material should be placed in the bottom of the nest box and a depression such as is made by the hen formed in it. The nesting material is placed on top of the earth and a rounded nest made. While the nest is being made, some tobacco dust or insect powder should be dusted over the earth and through the nesting material. If the nest is not modeled to suit her fancy, the hen will turn and scratch in it until she is suited. The hen prefers a nest that is round and hollowed out like a crock and deep enough to hide her from view. The material of which nests are made must be soft and elastic to prevent the eggs from being broken.

20. Caring for Nests.—In order that eggs may be presentable for market, it is necessary that the nests in which they are laid should be clean. Fowls must not be permitted to roost on the edge of the nest box, which they will most persistently try to do if the nests are exposed.

Nest eggs are of no value; they are frequently broken, and if made of hard material the eggs that roll against them are broken. Nest eggs are often responsible for the formation of the egg-eating habit in hens. The habit begins by the eating of the shell and contents of eggs broken in the nest. A broken egg soils not only the nest but any other eggs that may be in it. All of these misfortunes may come from leaving eggs in the nest. All eggs should be taken from the nests at least once or twice a day.

MANAGEMENT IN WARM WEATHER

21. House Cleaning.—As has been stated, poultry houses and their equipment must be cleaned frequently in order to maintain sanitary conditions. In addition to the regular daily or weekly cleaning of the dropping-boards, it is necessary that the whole house be cleaned thoroughly in the spring and in the fall. To do this work thoroughly, stiff brushes and brooms are useful. All dirt, dust, and litter should be swept from the floors, dropping-boards, roosts, and nest boxes; and the side walls and ceilings should be swept and dusted. The roosts, dropping-boards, and nest boxes should then be sprayed or painted with crude petroleum, kerosene, or liquid lice killer, the object of this treatment being to kill the lice that may be left in the house. The interior of the house should now be fumigated with carbolic acid or sulphur, or both. The house must be closed as tight as possible while it is being fumigated. For sulphur fumigation, candles made of sulphur are burned inside the house. A good method when using carbolic acid is to pour a quantity of the pure liquid on a brick that is almost red hot. The white fumes that arise will go into every part of the house. One sulphur candle or 2 teaspoonfuls of carbolic acid is sufficient for a house 16 by 20 feet in size. The fowls must be kept outside for at least 3 hours while the house is being fumigated, and before they go in again, the house should be opened and thoroughly ventilated.

22. Lime Wash.—A deodorizer, disinfectant, and purifier that is useful is **lime wash,** or **whitewash,** as it is usually called. But as a destroyer of insect vermin the wash alone is of minor importance. If carbolic acid is mixed into the wash its value as an insect destroyer is increased. The wash may be made by slaking a half bushel of lime in warm water, taking care to keep the containing vessel closely covered to retain the heat until the lime is thoroughly slaked. The milk-white liquid should then be strained through a fine sieve or through cheese cloth, and to the lime water should be added 1 peck of salt dissolved in warm water, 3 pounds of ground rice boiled to a thin paste, ½ pound of Spanish whiting, and 1 pound of glue boiled to a liquid. The mixture should then be added to 5 gallons of hot water, thoroughly stirred, strained, and applied while hot with a spray pump. If this wash is used cold, it may be necessary to dilute it with warm water before it can be applied with the spray pump. The wash may also be applied with a paint or whitewash brush. One ounce of carbolic acid mixed with each 6 quarts of this wash increases its value as a disinfectant and vermin destroyer, and the addition of a little bluing will whiten the wash. Copperas dissolved in water and mixed into the wash turns the color yellow when the wash is dry; the shade is regulated by the quantity of copperas used, 1 pound of copperas to 1 barrel of wash giving a straw color.

23. Open Windows.—Window openings must be covered on the outside with wire poultry netting the meshes of which are not more than 1 inch in diameter; larger meshes than this admit wild birds to the poultry house. The windows are of course kept open during summer weather, but other openings are usually closed in order to permit circulation without drafts. During very hot and sultry weather, all doors and windows may, however, be kept open, but when weather changes occur all the openings but the windows must be closed. Special attention should be given to the care of windows during the fall. During this season the fowls are exposed to much danger because the weather is liable to be cold and damp and the fowls themselves are molting.

24. Sun-Heated Houses.—When the sun casts torrid rays on the roofs of poultry houses, the air within them is liable to become almost suffocatingly hot unless it is released through the outlets in the roofs or close to them. The open loft above the hens, or open fronts and ventilators near or through the roof, if present may be depended on to release the overheated air, but in houses without any of these conveniences the heat may become sufficiently intense to develop ailments in the flock. The sufferings of the fowls from heat sometimes cause apoplexy, especially among very fat hens. To guard against excessive heat, a ventilator like the one shown in Fig. 1 may be built near the roof. For a house 12 feet long, the opening in the ventilator should be 6 feet long and 8 inches wide. The door *a* swings upwards and serves as a shelter from wind or rain; when the door is shut, circulation of air through the opening is stopped. The inside of the opening *b* is covered with 1-inch mesh poultry netting. During the winter a covering of muslin may be tightly drawn over the netting. Air will of course pass through the muslin when the ventilator door is open.

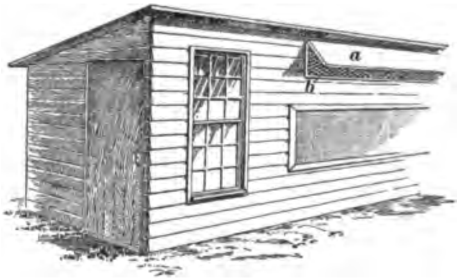

FIG. 1

MANAGEMENT IN WINTER

25. The care of poultry houses during winter would be a simple proposition were it not for the sudden weather changes that come during the night and at other times when they are least expected. These changes cannot be avoided or controlled, but the windows and ventilators can be adjusted to meet the changes when they come. If the fowls go from a warm roosting place into cold, damp air, the sudden change may chill their bodies and cause colds; if sudden temperature changes occur during the night and the fowls become chilled, the same evil consequences may result. To avoid these dangers, the curtains, windows, and ventilators must be adjusted to meet the demands of the occasion; if changes are needed at midnight, they should be made at that time and not on the following day. Sudden changes from a high to a low temperature or vice versa are injurious and dangerous. Ill health of fowls due to temperature changes can be avoided by prompt adjustment of windows and ventilators.

26. Drafts.—Health cannot be maintained where flocks of poultry are exposed to strong drafts. Drafts cannot occur unless there are openings in the walls or in the roof of the house. To avoid drafts, all openings except those necessary for the ventilation of the house must be closed. If the air comes through windows, as it should, a draft will not be created unless there are other openings. If all parts of the house are air-tight except the windows or ventilators and if these are properly regulated, there will be no drafts in the house even during the coldest weather.

27. The number of eggs obtained during cold weather is evidence of the success or failure in the management of the poultry houses. If the hens are in good condition and one hen in five lays daily during November and December it is evidence that the houses are being well managed. It is possible, however, by the practice of the most careful management of the flock of hens to increase this yield until one hen in three is laying daily. If the combs of the fowls are frosted, and no eggs are produced during the winter months, it indicates either that the houses are unfit for winter use or that the management of them is much at fault. To avoid dampness in the cold house during winter weather requires good ventilation, and this means that the combs are not frosted, nor the fowls chilled on the roost. If the ventilation is right, there is no excess of moisture in the air; with the air dry and the temperature not too frigid, the combs are not so apt to freeze as they are in warmer houses with excessive moisture. When prompt attention is given to the opening and closing of windows, curtains, and ventilators so as to adjust inside conditions to the weather changes, the house will be comfortable even during the coldest weather.

28. Care of Large Houses.—When several hundred hens are kept in flocks of twenty-five, more than double the time is necessary to care for them than for the same number when kept in flocks of fifty or more. The house for general use, described in *Poultry Houses*, Part 1, is well suited to the care of large flocks. Ninety hens can be comfortably cared for in each section of this house, and when the hens in each section become accustomed to their roosting places and nest boxes, if it is thought advisable to do so, the doors between two sections can be removed and the two flocks permitted to run together, thus lessening the labor of the attendant and giving each hen more room in which to exercise. If the hens are confined to the house continuously during the winter, as they must be in localities where the ground is covered with snow for months, the extra floor space thus obtained for exercise is beneficial to the hens. Such a house is intended for housing a large number of fowls on the farm in cold localities, and is well suited for the purpose, furnishing, as it does, ample room, extensive capacity, and good protection.

29. The loft overhead should be kept filled throughout the winter with straw to absorb the surplus moisture from below and to protect the inside of the house from the cold that comes from above. The loft and its contents need very little attention except that when the sun shines the loft should occasionally be ventilated by opening the doors in the gable of the house.

30. Artificial Heating.—Artificial heat in poultry houses is generally more injurious than beneficial to hens that are kept for egg production. Therefore, heated houses are neither practical nor profitable, and are not recommended for hens kept for the production of eggs for market. For these reasons it is important to distinguish between the use of the stove for drying the air in the hall and overhead loft between two houses and the use of stoves for warming the houses. It will usually be much better not to use stoves at all than to use them only for heating the houses.

The artificially heated house is, however, sometimes recommended to the fancier that grows fowls for exhibition and fits them for the show room, provided, of course, that the house is not kept overheated and is ventilated each day. Heated poultry houses may be used in winter to stimulate artificial growth or egg production just as green houses are used to hasten the growth of plants. Heated poultry houses are also used for winter brooding.

31. House With Stove.—The two houses described in *Poultry Houses*, Part 1, for the very cold climate are intended for housing laying hens during the very coldest weather. The use of the stove in these houses should be limited to the drying of the air in the halls and overhead; if the rooms are heated more than enough to do this the temperature within the pens will become too high. The stove is intended merely as an aid to ventilation, and not for heating the house. If the temperature in the pen is raised unnaturally during cold weather, the combs and wattles of the fowls grow and become tender, and in consequence are liable to be frosted during an unusually cold spell. On the contrary, if the air is dried, but not warmed, it will be free from moisture and the combs will not become soft and tender. To be successful with houses where the hens must be kept confined continuously day and night throughout the winter, the interior temperature must be regulated according to outside conditions. If it is extremely cold, the house should be closed, with no intake ventilation, and the outlet ventilators of the inside house should discharge into the space above with no outlet to the outside. During very cold weather the temperature of halls and loft should never exceed 32° F.

32. Glass Windows.—As has already been stated, houses can be ventilated through **glass windows.** When the weather is clear and cold, the top sash should be lowered enough to carry out any excess of heat caused by the sun. This sash should be closed as evening approaches and the lower sash raised, the open space below it being filled with a board, so that air will come into the house through the space between the two sashes. If the sash is raised 2 inches during cold nights, sufficient fresh air will be supplied. If the temperature is moderate, the sash may be raised from 4 to 6 inches. The open space at the bottom of the sash should always be closed at night with a board or cloth curtain.

33. Cloth Windows.—If clean and free from dust and dirt or obstructions of any kind, the **cloth window** will admit enough air into the house to keep its interior free from dampness, and at the same time, the cloth window will so modify the temperature that the inside of the house will be several degrees warmer than it would be without such a window. When the cloth window is supplemented with an enclosed roost, the combs of the hens within or beneath the enclosure will not freeze during the coldest nights. The claim is made that neither colds, roup, nor kindred ailments will attack fowls that are kept in the open-front or the cloth-front house. This statement cannot be relied on, however, for hens do sometimes contract roup while roosting in houses with cloth windows. Open- and cloth-front houses are very cold houses during cold weather, and if drafts blow on fowls within these houses ailments will result like those that come in houses that are not provided with cloth fronts. If the curtains in the front or over the roost are permitted to gather dust and close the mesh in the cloth, the circulation of air will be stopped and not only will the purpose for which the curtain is intended be defeated but their presence may prove more harmful than their absence would have been.

The temperature of a house with cloth windows, during cold weather, may be controlled by the opening and closing of these windows as weather changes require. When the weather is cold and stormy, the entire front of the house should be closed; as soon as the weather moderates, or is less inclement, the front should be partly opened; and when the weather is fine and mild the front may be left wide open.

YARDS

FENCES

34. Fencing Material.—The material most commonly used to make poultry yards is **woven-wire poultry netting,** the mesh of which varies from ½ inch to 2½ inches. **Galvanized wire** that is coarser in mesh and heavier than the ordinary poultry netting is also frequently used. Both types of the wire can be obtained in widths ranging from 1 foot to 8 feet. Board, picket, lattice, and other types of fences are occasionally used for poultry yards, but the use of these materials is by no means as general as that of the galvanized-iron wire.

35. The **posts** for the poultry yard should be made of cedar, oak, chestnut, or other durable wood, or of iron or reinforced concrete. If the fences are to be permanent and wooden posts are used, the lower part of them, from a few inches above the ground line to the base should be coated with hot asphalt or tar. Extra heavy posts must be used at the corners and ends of the fence, and these posts should be well braced. Round iron pipes, either bare or covered with concrete, are often used for posts where lumber is scarce. Iron posts are also used for ornamental or special fences. Galvanized-iron staples are commonly used to fasten the wire to the fence posts, although of course some other type of fastener is required where iron or concrete posts are used.

36. Height of Fences.—Ordinarily, a fence to a poultry yard should be made about 6 feet high, although the height depends somewhat on the kind of birds kept. A fence 4 feet high confines Asiatic fowls; one 6 feet high will do for Plymouth Rocks, Wyandottes, and other fowls of equal

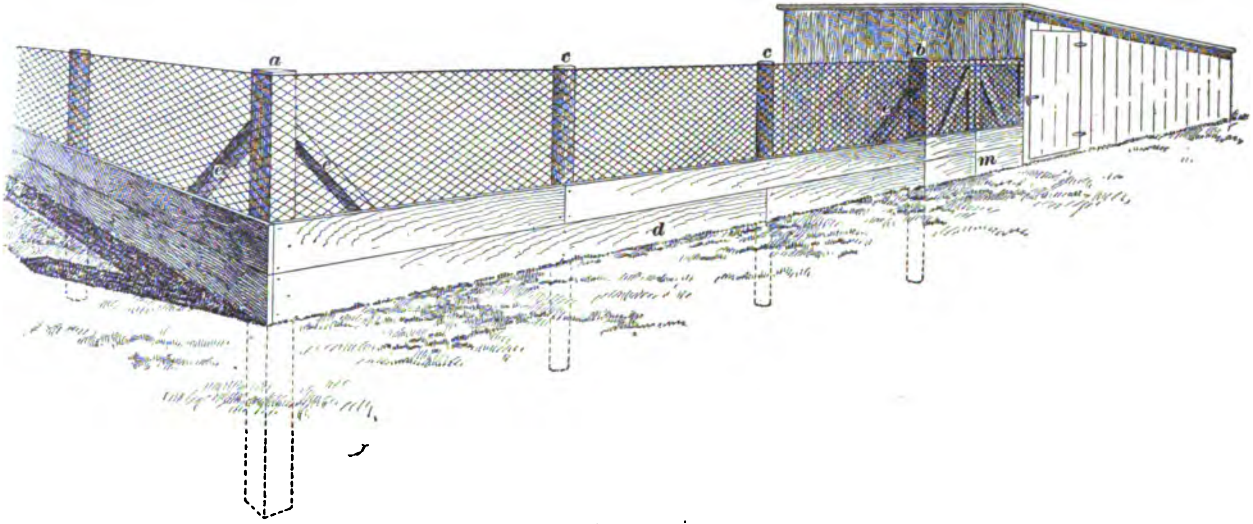

FIG. 2

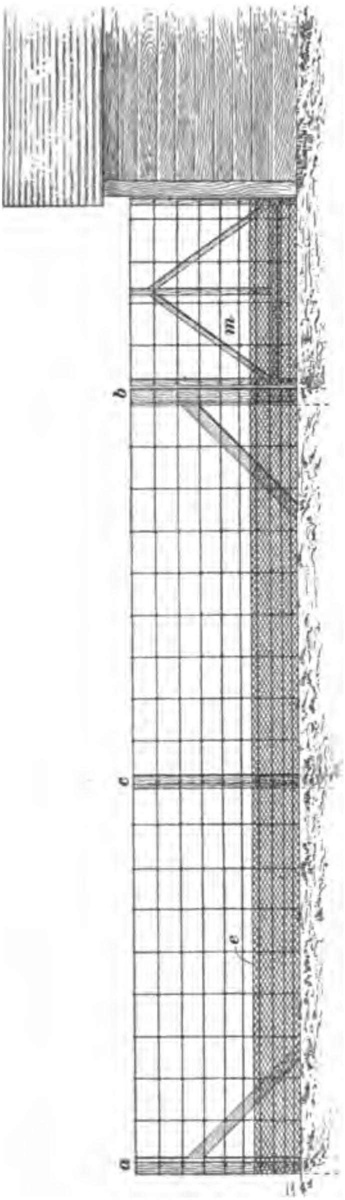

Fig. 3

size; but for Leghorns and other kinds that are light of wing, the fences must be 8 feet high. In making these high fences it is usually advisable to have the lower 3 feet made of boards and the upper part of poultry netting or slats.

37. Permanent Fences. To have a **permanent fence,** the posts should be set deep into the ground and braced, as shown in Fig. 2. The corner post *a* is 8 inches square, is set 4 feet into the ground, and is braced on two sides as shown at *e*. The end post *b* is also 8 inches in diameter, and is braced on one side. The other posts *c* are 6 inches in diameter and are set 8 feet apart. The boards *d* at the bottom help to keep the fence posts in line and the netting well stretched. These boards separate the flocks from one another and prevent the males from fighting; they are also beneficial as windbreaks when the wind blows cold.

38. Galvanized-wire fences like that shown in Fig. 3 are often used. The fence posts are set and braced the same as shown in Fig. 2, except that the distance between the posts may be greater. The posts *c* shown in Fig. 3 are 6 inches in diameter and are set 16 feet apart. The fencing is drawn tight with a fence stretcher and is fastened to the posts with galvanized staples. In erecting this kind of fence, the wire should first be tightly fastened to the end posts and then to the intervening ones. This style of fence can be made more substantial than can the fence made of poultry netting. To take the place of baseboards, close-mesh netting *e* is stretched along the base of the frame; the netting shown is 2 feet wide, and of 1-inch mesh. In order to have an opening into the yards, a movable section *m* can be made. Movable sections are generally placed next to the house in all yards, as shown in Figs. 2 and 3. This section *m* in both cases is 8 feet wide and can be taken away to allow a horse and plow to go into the yards to turn and to freshen the soil.

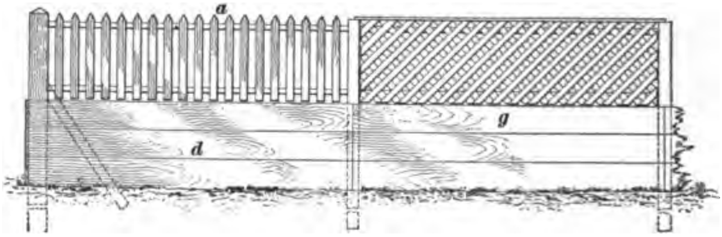

FIG. 4

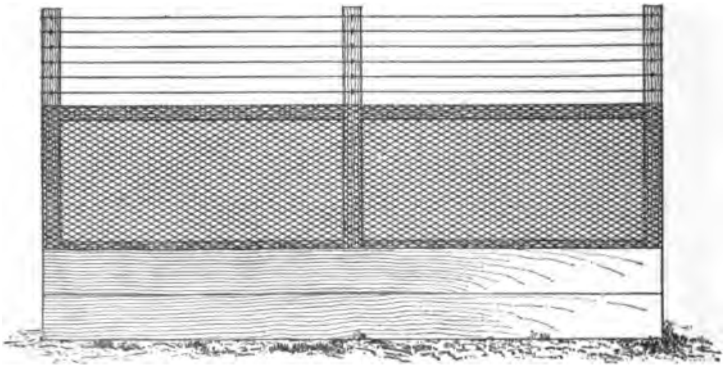

FIG. 5

39. Picket fences can be made as shown in Fig. 4, the pickets *a* being nailed to the frame above the baseboard *d*. The baseboards in this case make up the lower 3 feet of the fence and the pickets the upper 3 feet. A lattice fence as shown at *g* may also be made on a similar frame. Fences of this kind are often desirable and can frequently be used as a frame for climbing vines and bushes.

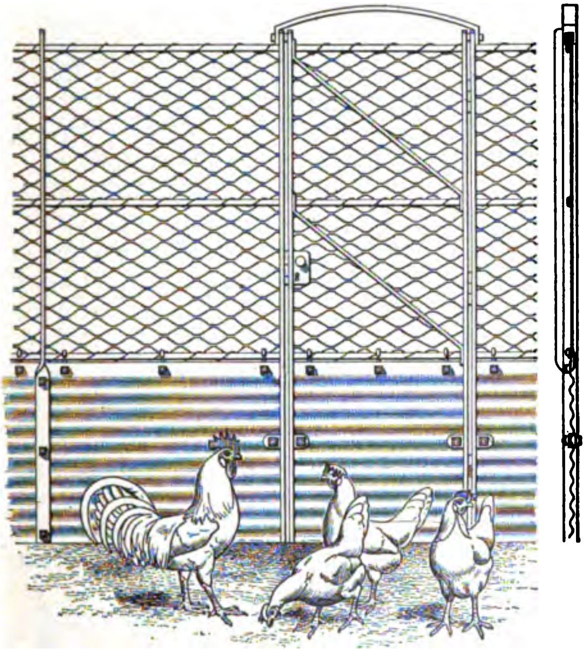

Fig. 6

40. Specially Made Fences.—To lessen the expense of building high fences the top part may be built as shown in Fig. 5. The bottom 2 feet of this fence is made of boards; above the boards is 4 feet of poultry netting; and the top 2 feet is made of wire fastened to the posts with galvanized-iron staples. This fence is lighter in weight and less expensive than the 8-foot fence shown in Figs. 2 and 3. To protect the poultry from wind and cold, a width of muslin may be placed between the netting and the posts. The muslin may be removed when the weather is warm, and rolled up and kept ready to be stretched along the frame as winter returns. Strands of wire may be added to the top of this fence in a manner similar to that shown in Fig. 8.

41. A **fence of corrugated iron and poultry netting** like that shown in Fig. 6 is on the market. Fences of this type are used for enclosing yards and parks where poultry, pheasants, or game are kept. The entire structure is of iron, and may be obtained in any reasonable height; the one shown is 9 feet high. This fence can be moved with little trouble, as it is only necessary to separate the different sections from the frame and draw the posts from the ground. This fence is an expensive one and for this reason it is not generally used. A stronger fence of the same general type is shown in Fig. 12. When a fence of this kind is nicely located, it is attractive and it makes a safe enclosure for fowls.

42. A **safety fence** is shown in the illustration of the house for high flyers described in *Poultry Houses*, Part 2. It is a stationary fence similar in construction to the movable iron fence shown in Fig. 8. When fowls cannot be confined within a yard with an 8-foot fence, a cover of wire netting can be put over the entire top of the yard; or a strip of netting 2 feet wide can be placed all about the inside of the fence in the same position as the wires *b* shown at the top of the fence in Fig. 8.

43. Movable Fences.—A few fowls may be confined for a limited time by the use of a **movable wire-netting fence.** To make this fence, posts that are 2 or 3 inches square, or round posts 3 inches in diameter, are pointed at one end and driven into the ground along the line of the proposed fence. Poultry netting is then stretched around them and fastened to them with galvanized staples. This forms a temporary yard for a pen of breeding fowls, or for a hen and brood, or for a number of growing chicks. The posts are readily drawn from the ground and the fence moved to a new location without detaching the netting from the posts.

44. A more substantial movable fence is shown in Fig. 7. This fence is built in sections, as shown in (*a*). The sections can be used to form a complete enclosure or to close the entrance openings *a* shown in Fig. 10. The posts *p* are 6 feet high, the baseboard *o* is 1 foot wide, and the wire above the baseboard is 5 feet wide. If desired, the baseboard may be made 2 feet wide and the wire 4 feet wide. By building in this way a better fence is made, because the 2-foot baseboard separates the fowls better than the 1-foot board. The cross-strip, middle upright, and braces are 6 inches wide and 1 inch thick. The corner posts may be either 2 in.×4 in., or 4 inches square. The footboard *f* shown in (*b*) is 6 inches wide, 4 feet long, and 1 inch thick; the braces *g* are the same width as the posts. The length of the sections must of course conform to the space they are to occupy, or they may be made in regular sections of 12,

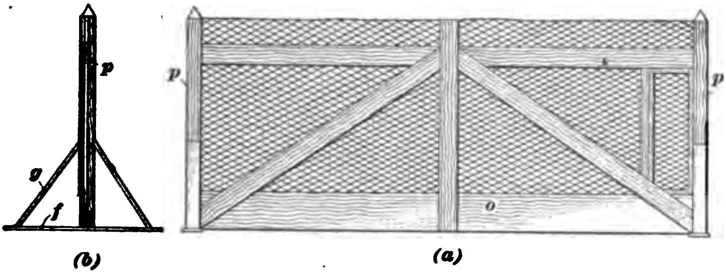

FIG. 7

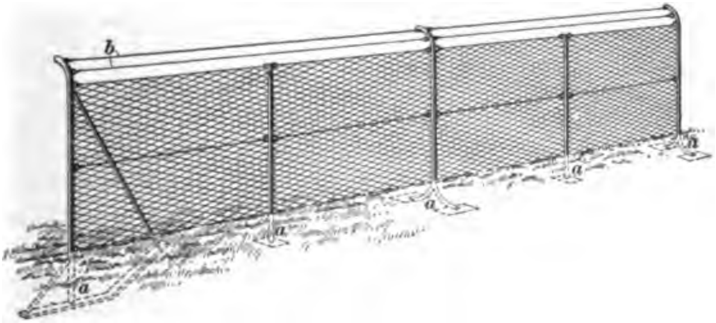

FIG. 8

14, or 16 feet, depending on the length of boards available. When these sections are used to close an opening in a fence, they are fastened to the fence posts with wire. If the sections are used to form a fence, long iron pins to keep the fence from falling are driven into the ground through holes in the footboard *f*. These movable fences may be made still more secure if they are braced on both sides with pieces of wood, the lower ends of the braces being driven in the ground and the upper ends fastened to the posts.

45. A movable **iron fence** is shown in Fig. 8. This fence is efficient and ornamental and can be used in the most exclusive neighborhoods without giving offense. It is a safety fence that confines fowls that are light of wing and also may serve as a trellis for climbing vines. The fence is made wholly of iron. The posts *a* extend into the ground as shown in the illustration. The entire fence is built in sections that may be quickly moved from place to place. This fence may be used as a line fence, a dividing fence, a lattice fence, or as a fence about a poultry yard. The only objection to its general use is its excessive cost.

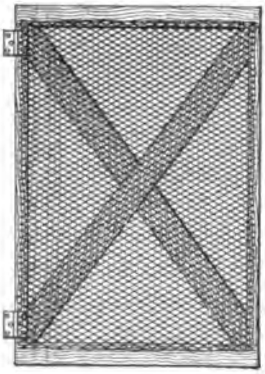

FIG. 9

46. Gates.—It is often convenient to have several openings into the poultry yards. These openings should be supplied with gates that are strongly made and hung securely to the gate posts. The gate posts should be strong and, to prevent the gates from sagging, the posts should be set deeply and firmly into the ground. Gates of wood should be framed and braced to keep them in shape. A gate made from a strongly built frame of wood covered with wire is shown in Fig. 9. The gate is hung to the fence post with strong hinges and fastened with a bolt or a fastener that cannot slip out of place when the gate is properly closed.

Iron hooks are also used to fasten the gates. Gates made of galvanized iron and wire netting to match the fencing used, can be purchased with it.

47. Windbreaks.—If poultry houses can be placed within the shelter of trees or with a hillside to the north, the best natural protection from wind and storms will be secured. Where winds are prevalent and there is no natural protection, **windbreaks** of some kind should be made or grown. Windbreaks may be made by growing evergreen or Osage orange trees near the house and between it and the place from which the prevailing winds come. High, strong, and closely built fences may also be used to shield poultry from storms. A combination windbreak of tight fence and trees may be made by building the lower 4 feet of the fence with boards, above which may be woven wire, and by planting some rows of evergreen trees beyond the fence in the direction from which the severe winds come.

ARRANGEMENT OF YARDS

48. Purpose and Size of Yards.—Fowls are confined in yards to prevent them from trespassing and from going where they may do harm or where they may injure themselves. They are also confined when an effort is being made to secure a large egg yield by intensive methods, and when several varieties of fowls are kept for breeding purposes, in which case the flocks must be kept separated in order that each breed may remain pure.

Yards cannot be too large and are frequently too small. Less than 100 square feet of yard room per head is not enough to secure the best results in producing eggs; a yard 50 feet wide and 100 feet long will be sufficient for fifty hens, provided special care is taken to keep the soil in a healthful condition. If the yard is 100 feet square, the fifty hens will do much better. Two and one-half acres will answer much better for five hundred hens in one flock than the same space divided into ten yards for fifty hens each. The reason for this is that when the five hundred hens are confined in the space of 2½ acres, each one has the free range of the entire area, and when the space is divided into 10 yards, each fowl is confined to a space about equal in size to that of an ordinary town lot.

Close confinement causes the flock to become discontented, and overcrowding the yard lessens the egg yield. If either one or both of these conditions is of long duration, the health and vitality of the fowls is undermined and destroyed. The Asiatic fowls can be kept in health and vigor in much less space than can the American varieties, while Leghorns must have more than double the space that is necessary for the other kinds of fowls. These remarks apply to the keeping of laying hens and not to forcing a few to an early maturity for the market on a space so limited that they neither produce eggs nor maintain vitality. The more closely hens are confined, the greater the necessity for cleanliness, care, and proper feeding.

49. Location of Yards.—Poultry yards located within the shelter of trees or to the leeward of them, are protected from winds during all kinds of weather. When such natural protection is impossible, yards are best located to the leeward of the poultry houses to have the advantage of the warmth of the sun and partial shelter from the winds during cold weather. Good drainage within the yards and away from the house also adds to the comfort of the fowls and helps to maintain their health.

50. Shape of Yards.—Yards for poultry must be made to conform to the space available for them. As before stated, yards that are square are less expensive to fence than long narrow yards of equal size, but the shape of the available space more often governs the shape of the yard than does any other feature. Square yards are not practical for apartment houses in which the pens have a frontage of from 12 to 16 feet. Under such conditions, the yards must necessarily be long and narrow in order to provide enough space for the fowls kept in these houses. Much may be saved, however, even on a limited space, by carefully planning for the best possible distribution of the space available.

51. Long Yards.—Where poultry is yarded on a limited space, or when the fowls are kept in separate pens for egg production and for breeding purposes, **long, narrow yards** are most frequently used. Yards suitable for a four-pen apartment house are shown in Fig. 10. The yards shown in this figure are 12 feet wide and 50 feet long; but they can be double or treble this length if the space permits it. In front are four yards *b* equal in width to that of the pens *e*. The gates *a* in the yards are made of movable sections like the other parts of the fence, as shown in Figs. 2, 3, and 5. Similar gates that are large enough to permit the passage of a horse and harrow connect yards *b* and *c*. The fowls go into the grass plots *c*, through the gates *d*; each pen of fowls can run for 1 hour each day in this plot without injury to the grass. In periods of deficient rainfall, the grass plot should be watered each evening to keep it fresh for the fowls. A row of trees to furnish shade for the poultry should be planted through the middle of the grass plots as shown in the illustration. The long yards *b* should be cultivated frequently with a harrow, hoe, spade, or rake to prevent the soil from becoming tainted and infected with disease germs. A small gate is made in all of the movable sections *a* in order to have a convenient entrance to each yard.

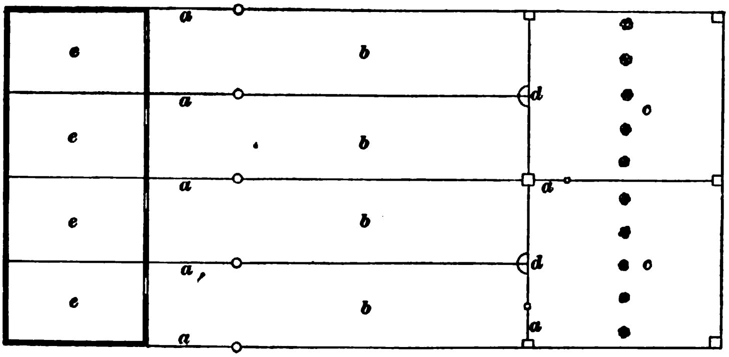

FIG. 10

52. Divided Yards.—When a few fowls are confined in connected houses with yards, the yards as ordinarily situated must be either very long or quite small. To obviate this defect and to provide an open run in which green foods may be grown, the yards may be built on all sides of the house, as shown in Fig. 11. On each side of the house are four small yards *a*, *b*, *c*, and *d*, and two large ones *g*, *h*, *i*, and *j*; the two small yards *a* are for the use of the fowls in pen h_4. For 2 weeks the fowls in this pen run continuously in the south yard *a*; and during these 2 weeks they are permitted to graze for 1 hour each day upon the grass plot *g*. During the next 2 weeks they run in the small yard on the north side of the house, and graze in the grass plot *i* for 1 hour each day. While the fowls in the pens h_4 and h_2 are running in the southern yards those in pens h_3 and h_1 are running in the north yard. When one pen is shifted, all are shifted, so that each lot of fowls will always have a comparatively fresh grass plot. Yards *e* and *f* are for the use of extra males, broody hens, or for mother hens or ducks.

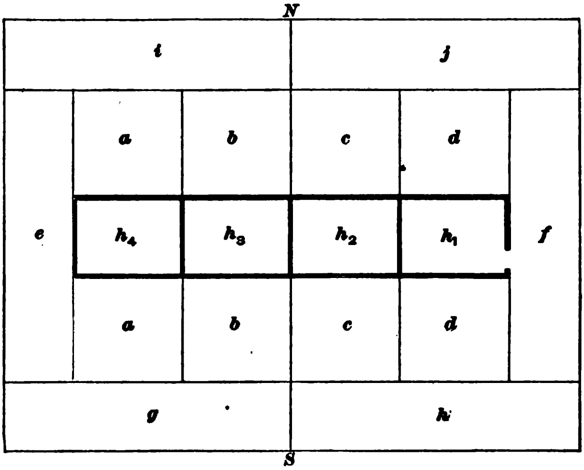

FIG. 11

The four large yards have a thick-grown sod of grass and clover and the eight small yards should be sown with oats or screenings. After a small yard has been used for 2 weeks, and has been vacated, it is dug up and sown with oats or screenings. In this way the soil is freshened and a new plant growth started in the small yards every 2 weeks. During hot or dry weather when there is not enough rainfall the grass plots and the yards that have recently been sown should be thoroughly moistened each evening to insure a good supply of green food. Yards arranged in this way furnish plenty of natural green food for hens, provided the yards are cared for as they should be and are not overtaxed with hens.

53. Colony Yards.—A yard 40 feet square contains 1,600 square feet and requires 160 feet of fencing to enclose it; a yard 20 feet wide and 80 feet long contains the same number of square feet and takes 200 feet of fencing to enclose it, 40 feet more of fencing being required to enclose the long narrow yard than the square one. For this reason, if for no other, the square yard is preferable. Large square yards should be used for colony flocks, and the poultry house should usually be placed in the center of the plot, but when many colonies are confined in a limited space, the houses are placed on the outside of the fencing in order to lessen the time and labor spent in caring for the house and fowls. In large poultry plants the colony houses are placed 20 or 30 feet apart on several acres of land, and all of the houses are enclosed in one yard with a single line of fence about the field.

54. Protected Yards.—It is often desirable to enclose yards with a substantial iron fence to protect the poultry from foxes and other animals. A fence suitable for this purpose is shown in Fig. 12. The entire fence is made of iron, the posts being iron pipes and the frame iron rods. The fence is 8 feet high and its frame is covered with heavy iron-wire screen and the house itself is of corrugated iron. A strip of corrugated iron about the base of the fence protects

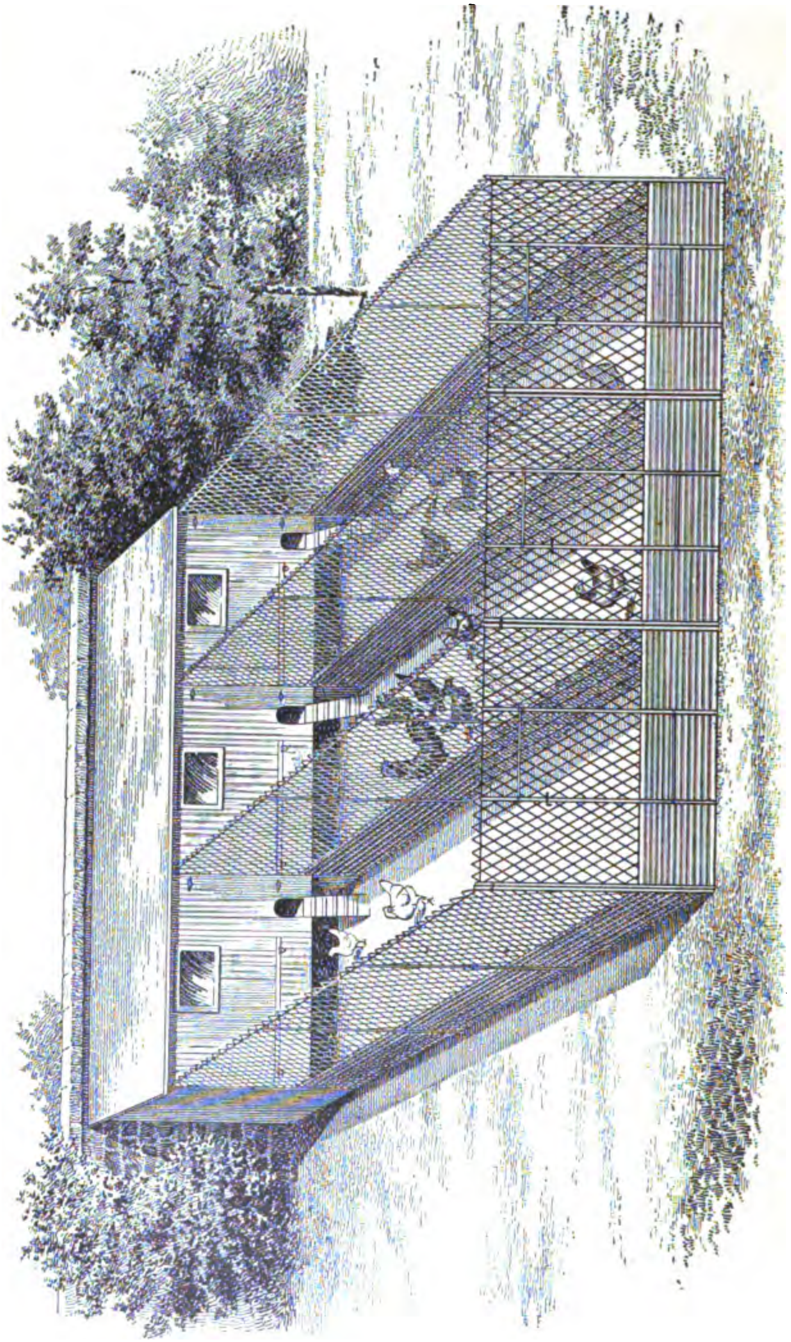

FIG. 12

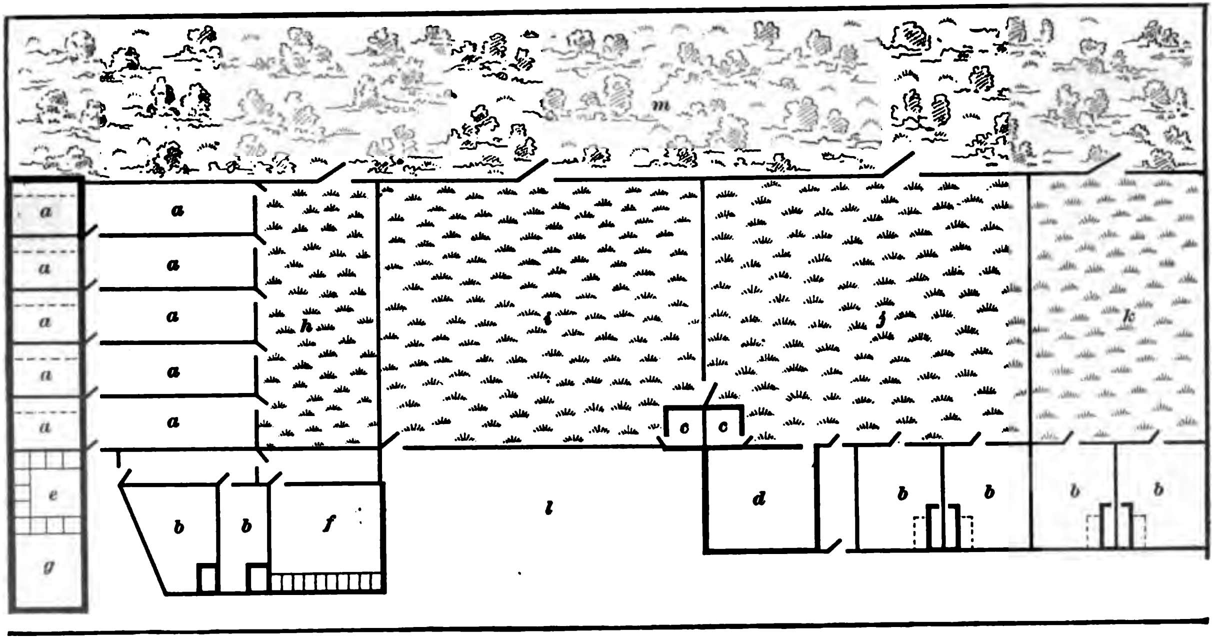

Fig. 13

the fowls and prevents the males from fighting through the fence. An enclosure like this is especially adapted for game fowls. Such yards are suitable for the lawns and parks of rural homes where they can be situated among the trees and shrubs and away from the dwelling. Sections of fence like that shown in the figure are made by fence makers, on order.

55. Breeding Yards.—Properly arranged **yards for breeding fowls** aid in the handling of the fowls and their product. A convenient arrangement for breeding houses and yards is shown in Fig. 13. The entire plot is 100 feet wide and 200 feet long, and is divided into smaller plots for the convenience of caring for the stock. The large house and yards *a* all open into the grass plot *h*; the pens *b* are for young chicks; the small pens *c* for extra males, and the pen *d* for surplus females. The room *g* is a storage place for grain and utensils; the large room *f* is for sitting hens and their nests. The preparation room *e* is equipped with coops in which the fowls are trained for exhibition. The extra, or surplus, males and the young cockerels run in the grass plot *i*; the surplus hens and the young pullets have the freedom of the grass plots *j* and *k*. All grass plots connect with the large grass run *m*. Shrubs, and fruit trees such as peach, plum, and apple, should be planted in all grass runs. Access may be had to all houses and yards from the gravel walk *l*; and the entire plot may be separated from the dwelling by a lattice fence.

CARE OF YARDS

56. Tainted Soil.—Tainted or polluted soil is detrimental to the health of fowls, but more dangerous even than this condition is the use of wet or marshy land as a runway. Long grass that gathers and holds the poultry droppings and prevents the poison in them from being washed down into the soil is also a source of disease. For this reason the grass in poultry yards and runways should be cut and raked frequently. Soil too frequently worked over by the hens is often so badly tainted that it spreads liver troubles among the fowls. Fowls kept on such soil soon lose their activity and become afflicted with malaria. Tainted soil that is devoid of grass should be covered with lime and be left fallow for several weeks before being plowed under; after plowing and before it is used again for poultry, at least one crop should be grown upon the ground. Tainted grass lands should be mowed, raked, and, if needed, lightly harrowed, seeded to grass, and left for purification by Nature. Lands maintaining a growth of grass are quickly renewed if treated in this way. Soil without grass can be kept healthful in poultry runs for many years by frequently turning the soil, thereby freshening the soil and placing the filth below the surface, where it is absorbed or washed away.

57. Shade.—Fruit trees may be planted in poultry yards to **shade** the fowls from the sun. Apple, peach, or plum trees are the kinds most frequently used for this purpose. The fruit that falls is relished by the fowls, and the birds protect the trees from the ravages of many insect pests. Yards that are devoid of natural shade should be supplied with artificial shelter of some kind to protect the fowls from the sun during hot weather. Climbing vines, such as morning glories or hop plants, grown on wire netting, strips of wood, or branches of trees laid upon the top of the fence make a natural shade that is acceptable to the fowls. Grape vines planted about the outside of the poultry yard and trained above the fence top on frames are also used to shade poultry yards. Temporary shelters may be made by stretching muslin over the top of the fence close to the front of the house, thus shading the ground just in front of the house and the interior of the house.

58. Cleaning of Yards.—Small yards for a few fowls are kept clean if the surface is frequently swept with a rattan brush or broom. After this surface filth has been removed, the ground is thoroughly dug up and oats or screenings are sowed and raked in and the ground leveled. The fowls will scratch and dig in the ground for grain and by so doing, keep the soil in fairly good condition until it is solid under their feet. It should then be swept, dug, and seeded again. By repeating this practice at intervals, the soil is prevented from becoming tainted. Ground within large enclosures of land that is devoid of growth must be frequently plowed or harrowed, and oats or screenings sowed sparingly and harrowed in so that fowls can dig and hunt for the grain. Yards having a profuse growth of grass must be mowed when the grass becomes tall in order to prevent it from becoming tainted. If the grass supply is failing, the ground should be stirred with a sharp-toothed harrow and sown to grass and leveled with a roller or a heavy brush harrow. The fowls should then be kept out of the yard until the new growth has formed a sod.

POULTRY FEEDING

(PART 1)

PRINCIPLES OF FEEDING

COMPOSITION OF FOOD

1. Food is any substance that a plant or an animal may take into its body and use there for building up wasted tissues and maintaining natural conditions. Besides *water*, which is present in all foods, the different compounds of which solid animal foods are composed have been grouped into four classes: *carbohydrates*, *fats*, *protein*, and *ash*. It should be remembered that not all the compounds belonging to these classes, which are also known as food elements, or principles, are completely digestible, and that the value of poultry food is determined largely by the amount of these food constituents that can be digested by the fowls. When food is digested it forms blood, which circulates throughout the body and sustains life. By means of the blood the nutritious portions of the food are assimilated, or incorporated into the body of the fowl for the purpose of nourishing it and for renewing wasted tissues. Eggs are composed largely of the same kind of materials that are utilized in the formation of blood and flesh.

The bones, muscles, internal organs and all other parts of the body are nourished by food. From the water that the fowl drinks, together with that contained in the food it eats, is made up more than 50 per cent. of its live weight;

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the fat constitutes 20 per cent.; the ash, 4 per cent.; and the protein, more than 20 per cent. Nearly all of the grains commonly fed to poultry contain more carbohydrates and fats and less protein and ash than the fowls require. Both the muscles of the fowl's body and the material constituting its eggs are largely made up of protein, and since this element is present in most foods in relatively small quantities, protein is the most difficult and expensive part of the ration to supply.

2. **Water.**—As has been said, all foods contain **water;** dry grains, meals, and hays contain from 7 to 10 per cent., and grasses, green plants, roots, and unripened grains contain from 60 to 70 per cent. of this vital fluid. The flesh of fowls and their eggs are from 41 to 65 per cent. water, 1 dozen new-laid eggs containing almost a pound of water. From the foregoing, it will be seen that plenty of water is one of the first requisites for successful poultry feeding. The natural food of poultry—seeds, grass, and bugs—is well supplied with water and the other food principles that are required to sustain life and to make the fowl capable of producing eggs.

3. **Carbohydrates.**—The greater portion of the solid part of poultry food is composed of **carbohydrates,** or **nitrogen-free extracts** as they are sometimes called. Carbohydrates are made up largely of starch, sugar, gums, vegetable acids, and crude fiber. Carbohydrates are used by the fowls to supply energy, to produce animal fats and oils and to maintain the body heat. The *calory*, which represents the amount of heat required to raise a kilogram of water 1° C., is often used in expressing the heating power of foods. For example, if it is said that a certain quantity of food has a heating value of 6,000 calories, it is meant that the amount of food in question if burned, would raise 6,000 kilograms of water 1° C., provided, of course, that all the heat developed by the combustion of the food was utilized for the purpose of heating the water.

Foods that contain a large proportion of crude fiber are spoken of as *roughage*, while those that contain little crude fiber and that are nearly all digestible are known as *concentrates*. Clover hay is an example of roughage, while corn meal is a concentrate. Although of little direct value as a food for poultry because the great bulk of it is passed off as waste, crude fiber is of vital importance to the fowl in assisting it to digest the concentrated part of the ration. Little of the crude fiber of wheat and its by-products is digested, and yet these materials are among the most highly favored poultry foods. The importance of crude fiber in a food lies in the fact that in passing through the digestive organs it distends them and serves as an irritant that stimulates their mechanical action and assists them in digesting their contents.

4. Fats.—The food elements known as **fats,** or **oils,** differ from carbohydrates in being able to produce more heat. For this purpose, one part of fat is equal to 2¼ parts of carbohydrates. For this reason, when estimating the heating value of foods, it is customary to multiply the amount of fat in them by 2¼ in order to express its equivalent in carbohydrates. The fat of foods that is not immediately required for producing energy and warmth is stored in the body for future use.

5. Protein.—That portion of food which contains nitrogen is known as **protein.** The lean meat of the fowl and the white of the egg are composed largely of this principle. In fact, every portion of the body of the fowl contains some protein, and there must be protein in the food eaten by the fowl in order for it to live. Although protein can take the place of fat and thus become a substitute for the oil contained in food, neither carbohydrates nor fats can be used as a substitute for protein. As a source of heat and energy, it is about equal to the carbohydrates, but animal heat obtained from protein is very expensive. Protein is much more costly than the carbohydrates and fats, and no more of it should be fed to fowls than is absolutely necessary to renew waste, make new growth, and furnish the needed quantity for egg formation.

6. **Ash.**—That part of food which would be left if the food were burned is called **ash,** or **mineral matter,** and it contains calcium, magnesium, potassium, sodium, iron, and other elements. When assimilated by the fowls, ash enters largely into the composition of bones and the shells of the eggs. There is not enough ash for egg and bone formation in the food usually fed to fowls, and for this reason it is necessary to supply them with such materials as clam shells, grit, etc.

7. **Nutritive Ratio.** — A 4-pound fowl needs in its daily grain ration about ¼ ounce of protein, 1¼ ounces of carbohydrates and fat combined, besides some ash. The relationship between the amount of protein and the amount of carbohydrates and fat present in a food or ration is often expressed numerically. For example, a ration containing food principles in the quantities mentioned is said to have a **nutritive ratio** of 1 to 5; that is, it contains 5 times as much carbohydrates and fat as protein. A food or ration is said to have a *narrow nutritive ratio* when the proportion of protein to carbohydrates and fat is large, and a *wide nutritive ratio* when the reverse is true. A 4-pound hen should have a daily ration of grain that contains 2 ounces of dry matter, this ration being made up of .4 of an ounce of protein and 1.6 ounces of carbohydrates and fat combined; this is a 1-to-4 ration, and as it contains the carbohydrates and fats in the correct proportion, it is known as a *balanced ration.* In addition to the material contained in the ration mentioned, fowls must have green food, water, and grit. Some rations contain as much as .5 ounce of protein and 2.25 ounces of carbohydrates and fat combined. Such rations have a nutritive ratio of about 1 to 4½.

DIGESTION OF FOOD

BODY OF THE FOWL

8. The amounts of water, ash, protein, and fat present in the bodies of various classes of poultry are shown in Table I. From this table it is seen that the body composition of a hen is about the same as that of a pullet. The analyses of different specimens in each class differ quite as much from one another as do those of the hen and pullet given in the table. A capon or a fat fowl has less water and protein in its body and considerably more fat than a laying hen or a pullet. The body of a fowl consists of lean meat,

TABLE I

COMPOSITION OF FOWL AND EGG

	Water Per Cent.	Ash Per Cent.	Protein Per Cent.	Fat Per Cent.
Hen	55.8	3.8	21.6	17.0
Pullet	55.4	3.4	21.2	18.0
Capon	41.6	3.7	19.4	33.9
Fresh egg	65.7	12.2	11.4	8.9

TABLE II

COMPOSITION OF TYPICAL POULTRY FOODS

Food	Water Per Cent.	Ash Per Cent.	Protein Per Cent.	Total Carbohydrates Including Per Cent. Fat ×2¼
Corn	11.0	1.5	7.9	76.4
Oats	11.0	3.0	9.2	56.8
Meat scraps	10.7	4.1	66.2	31.1
Green clover	71.0	2.1	2.9	16.4

fat, bones, feathers, etc., and the food consumed by it must contain all the materials of which its various parts are made up, or the fowl will lose weight and die.

Table II gives the analyses of some typical poultry foods. The bones of the fowl are largely made up from the ash in the food, and from the protein is obtained the lean meat, while the carbohydrates and fat furnish the animal heat and energy. All of the different food principles are necessary for the formation of the egg and for the growing of the chick. The feathers of a fowl are made from nitrogenous foods and mineral matter.

In order to understand properly how the process of the digestion of food and the building up of the hen's body goes on, it is necessary to know something of the internal anatomy of the fowl and how it digests its food.

INTERNAL ORGANS OF POULTRY

9. The process of digestion in poultry differs materially from that of farm animals that chew their food. The functions of teeth which fowls lack are performed by the gizzard, which grinds their food into pulp. Fowls also secrete less saliva than do other farm animals. The greater portion of the food of poultry is swallowed whole and passes in that condition to the crop, where it absorbs considerable moisture before it is passed to the other digestive organs. A general view of the internal organs of the hen is shown in Fig. 1. After being taken up by the mouth, the food passes through the upper portion of the esophagus *a* into the crop *b*; from the crop the food passes through the lower portion of the esophagus into the gizzard *c*, and from there through the other organs of the digestive system.

10. Crop.—In fowls and other granivorous, or grain-eating, birds, the **crop** is relatively larger than the crop of birds like ducks and geese that feed largely on grass; the reason for this is that in birds of the former class the crop is used as a storage place for food, while in those of the latter class the esophagus is enlarged for the same purpose. The crop

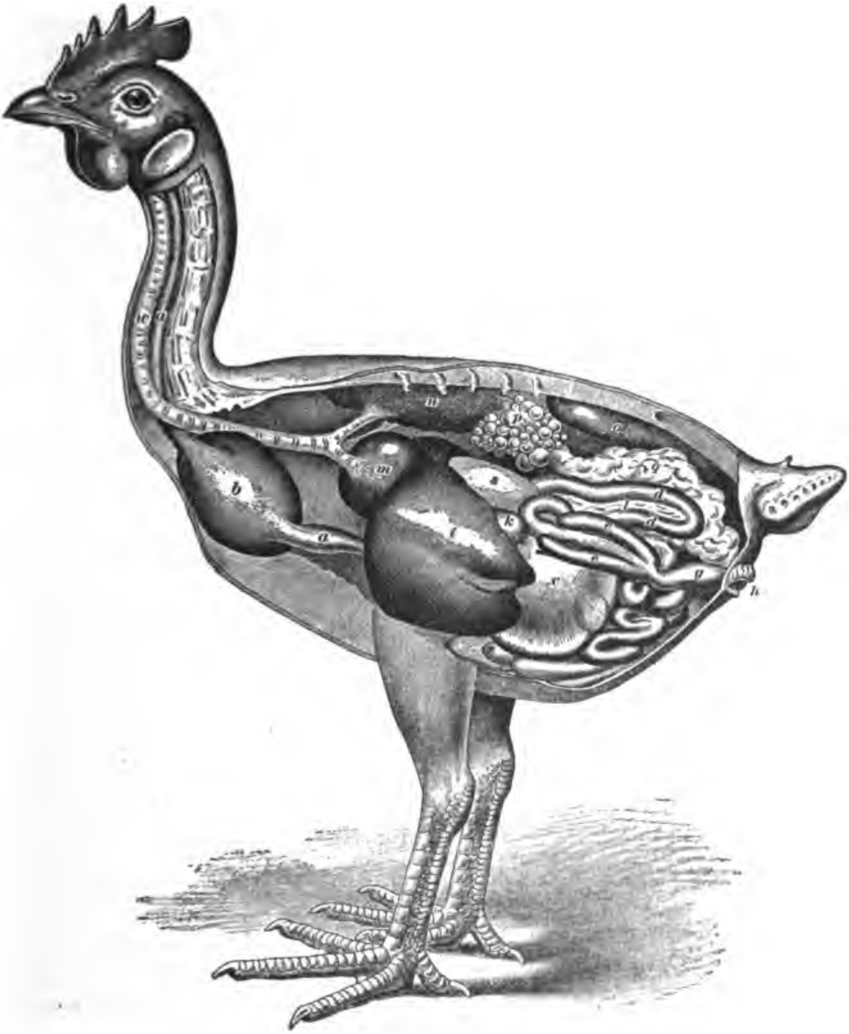

Fig. 1

may be so distended by irregular feeding, overfeeding, or by the eating of indigestible food that its inner lining becomes irritated and so swollen as to close completely the passage to the gizzard. A fowl in this condition is said to be *crop-bound.* Within the crop are juices that moisten the food and hasten its passage into the gizzard.

11. Gizzard.—The **gizzard** *c* may be looked upon as a powerful grinding machine in which the whole grain and other foods of poultry are ground, oftentimes finer than they would be ground by the teeth of chewing animals. The grinding is accomplished by means of the powerful muscles of the gizzard, which keep the mixture of sand, grit, and food within it constantly in motion. After being used for some time, the grit particles become rounded and unfit for further use. They are then passed into the intestines and out of the body as waste. From the foregoing it will be seen that a plentiful supply of grit is necessary for the welfare of the fowl. Not only is the food ground in the gizzard, but it is also acted on by digestive juices before being passed into the intestines.

12. Intestines.—The term **intestines** as applied to fowls means all of the alimentary canal beyond the gizzard. The intestines of the fowl, although different in many respects from those of other animals, present a somewhat similar appearance and have functions nearly identical with those of the other domestic animals. In fowls, the intestines are made up of the *duodenum*, and the rest of the *small intestines d*, the *cæca e*, and the *large intestines* and the *rectum g.* Inside of the intestines the food is acted on by various digestive fluids, and digestible nutrients within the food are taken from it and eventually converted into blood. The process goes on as follows: The inner walls of the intestines are covered with minute projections known as **villi,** which absorb the digested material from the contents of the intestines. Within the villi are two kinds of small tubes or capillaries. One kind connects with the lymphatic, or waste-gathering, system of the body and conducts material that would otherwise be wasted to a large tube or reservoir situated along the backbone. The contents of this tube are eventually taken up by the blood. The other kind of tubes belong to the blood circulatory system; they absorb other digested material and carry it to the liver, where it is purified before being used to build up and maintain the body. The indigestible portion of the food passes into the rectum *g* and out of the body through the vent *h*.

13. **Liver.**—The **liver** *i* is a large, two-lobed organ of peculiar cellular structure. The liver has two offices, one of them being to purify the digested material brought to it by the capillaries, and the other to secrete the bile, an important digestive fluid. The importance of keeping the liver in a healthy condition can be realized when it is understood that unless this organ performs its functions properly, the blood, and consequently the entire system, will speedily become poisoned.

14. **Gall Bladder.**—The **gall bladder** *k* serves as a reservoir for the bile secreted by the liver, to which it is closely attached. The bile is passed, as needed, from the gall bladder to the intestines, where its special office is to break up the vegetable fats and oils and convert them into soluble animal fat, which is readily made a part of the fowl's body.

15. **Spleen.**—The **spleen** *s* is located near the liver and is an organ whose use is not definitely known. It is thought, however, that it is useful in producing certain modifications in the blood.

16. **Pancreas.**—Situated among the folds of the small intestines is the **pancreas** *l*, a small organ of insignificant appearance. Although of small size, this organ is of vital importance, for in it is secreted the pancreatic juice. The pancreatic juice flows from the pancreas into the intestines, where it acts directly on the starchy portions of food, and to a limited extent on protein; it also aids in the absorption of fat. The juice from the pancreas unites with the bile and they together flow over the foods as they come from the gizzard.

17. Heart and Lungs.—The **heart** *m* and the **lungs** *n* are vital organs. The work done by the latter, like that of the liver, consists in purifying the blood. The office of the heart, as is well known, is to pump the blood to all parts of the body. The heart, lungs, and liver may be considered as the most important organs of the body, and care should be taken to keep them in good working order, for when the action of one of these organs is faulty, the effect is soon apparent on the others. The air is supplied to the lungs through the windpipe *w*.

18. Kidneys.—The **kidneys** *o* are located in cavities in the pelvic bone. These organs act on the blood and separate from it liquid waste material, which is eventually passed from the body through the vent.

19. Ovaries and Oviduct.—The functions of the **ovaries** *p* and the **oviduct** *q* will be described in *Natural Incubation.*

CONDITIONS THAT INFLUENCE DIGESTION

20. Palatability.—Food that is relished when eaten is more readily digested than unpalatable food. Although unpalatable food will satisfy the demands of hunger, food agreeable to the taste leads to better digestion. The appetite of fowls may readily be stimulated by giving them a ration that is attractive to them and that they will eat with a relish. So important is this quality of **palatability** in a ration that one flock of hens may be kept in excellent condition and health as the result of having been fed a mixture of palatable grains, while another flock fed on the same kind of food will be badly out of condition for the simple reason that the ration was so poorly fed as to be unpalatable. To make a ration attractive to fowls, several kinds of grain may be fed together or a different grain may be fed at each successive meal. Otherwise useful grains frequently become unattractive to fowls and cause indigestion for no other reason than that the same kind of grain is fed for too long a time. Although agreeable taste adds nothing to the intrinsic value of a food, its beneficial effect on digestion is so important an item that it should be given serious thought in the feeding of poultry.

21. **Manner of Feeding.**—Overfeeding, especially with concentrated foods, interferes seriously with good digestion. In fact, any food that will distend the crop and overload the digestive organs is injurious. Irregular feeding or the exclusive feeding of one kind of food, or the feeding of excessively nitrogenous, starchy, or fatty foods are the causes of many troubles in the digestive organs. All of these troubles can be avoided through frequent feeding in small quantities, for such feeding will encourage constant digestion and produce few unnatural demands on the digestive tract.

22. **Preparation of Foods.**—Many foods can be made more completely digestible by being ground into meal before being fed. The by-products obtained in the manufacture of human food are often of value as poultry food. It is generally advisable to feed these finely ground preparations in the dry state, because fowls that are plentifully fed on wet mash suffer from liver trouble; and if an exclusive diet of wet mashes is long followed, the life of the fowl is in danger. When fed dry, these finely ground preparations do not distend the digestive organs; when fed moist, they pass more quickly through the system and disturb the organs of digestion. Foods that are naturally palatable cannot be made more so, although some kinds are frequently made more digestible either by cooking or by grinding.

23. **Selection of Foods.**—Care should be taken to select foods that contain relatively large amounts of digestible nutrients and little waste and crude fiber. Care should also be taken to select a palatable ration with the proper nutritive ratio. The ration should also contain enough of the various food elements and sufficient crude fiber for good digestion. Should these conditions be fulfilled, the demands of the body of the fowl will be fully satisfied without crowding unnecessary labor on the digestive organs.

USES OF THE FOOD PRINCIPLES

24. After being digested and absorbed by the blood vessels, the different food principles are used by the body for various purposes. From protein are formed the muscles, or lean meat, and this principle also enters largely into the composition of the bones and feathers, and, most important of all, the egg. Protein can be more completely utilized than the other food elements and some hens seem to have the power to utilize practically all of the protein contained in the food they eat. As has been said, protein will take the place of carbohydrates and fats when these principles are lacking. This thing should not, however, be permitted to take place, both on account of the excessive cost of energy furnished by protein and because excessive quantities of protein are liable to injure the health of the fowl.

Carbohydrates are mainly used, as has been noted, to keep up the body temperature. The utilization of carbohydrates for this purpose is really a slow form of burning, which is just as necessary for the life of the fowl as the fire beneath the boiler is for the running of the steam engine. Unless the proper body temperature is maintained, the functions of the various organs will be interfered with and death will soon take place. Carbohydrates are also the source of much of the energy used when the fowl moves itself about and performs other work.

The function of fats is similar to that of the carbohydrates. Fats, however, are a more concentrated fuel, a pound of fat being equal to about 2¼ pounds of carbohydrates. Fats can also be stored for future use in the fowl's body, a thing that cannot be done with carbohydrates.

These various food principles are taken by the blood to the parts of the body where they are required. The heart and lungs are necessary for the performance of this work. These organs are closely connected with the liver. The office of the heart, as is well known, is to pump the blood to every part of the body; that of the lungs is to purify the blood by exposing it to the action of the fresh air. The lungs are very important organs and are susceptible to many kinds of disease. The importance of keeping them healthy can be realized when it is known that life is in danger when constant purification of the blood is prevented. After being purified by the lungs, the blood passes to the heart and from there is forced into the arteries, which extend into every part of the body. The blood carries with it the material needed to build up the different parts of the body, and also takes from those parts much worn-out material.

POULTRY FOODS

SEEDS AND THEIR BY-PRODUCTS

IMPORTANCE OF QUALITY

25. Foods the quality of which is unquestionably good are the most economical for poultry. Shriveled, immature, or imperfect grains do not contain the full amounts of digestible nutrients, and these grains are liable to be deficient in that most desirable and expensive food principle, protein. In order to realize the best results none except good, plump, mature grains should be used. The same principle applies in selecting the by-products of grains—only the best should be chosen.

The relative value of poultry foods can best be estimated when the food value of each is well understood. It will usually prove more profitable to buy the foods rich in protèin than those that are lacking in this valuable principle.

WHEAT

26. Whole Wheat.—A grain of **wheat** is made up of an outer shell, an inner lining, and a food center, its structure in a general way resembling that of an egg. The shell of the wheat kernel is composed largely of crude fiber; the central portion contains some protein, but consists mainly of starch. The protein, or gluten, of the wheat is the most valuable part of it, and no other grain will fill the place of wheat as a food for the production of lean meat and eggs by fowls, Wheat is rich in both protein and the fat-forming principles, but it is a better food for making blood, flesh, and feathers than for fattening purposes; hence, it is a better food for egg-producing hens than for those intended for the market. Whenever possible, wheat should be one of the several grains used in making up a ration for fowls. Although the best whole grain for hens, it does not form a perfect ration when fed alone.

Second grades of wheat can be purchased at a lower price than the higher grades. If they are sound and have good feeding qualities, these second-grade wheats can be used to advantage; but if they are shriveled or blighted, they have little value. Burned, wet, musty, or otherwise damaged grains are not fit for feeding poultry.

Table III shows the digestibility of the various food principles found in wheat of good quality. Although about 20 per cent. of its dry matter is indigestible, wheat, on account of its palatability, is the best possible whole-grain food for fowls.

TABLE III

DIGESTIBLE MATTER IN WHEAT

Parts of Wheat	Per Cent. Digestible	Parts of Wheat	Per Cent. Digestible
Organic matter ..	81.86	Crude fiber	None
Protein	77.12	Carbohydrates ...	86.59
Fat.............	39.67		

27. Wheat Screenings.—The value of **wheat screenings** as a food depends on the amount of weed seeds and other materials that are mixed with the wheat of inferior quality. Good wheat screenings have a food value equal to that of oats, while screenings of poor quality have a food value that may be less than that of oat hulls or straw. Although fowls will eat a large portion of the weed seeds in screenings, many of them have no food value; consequently, the matter of selecting and feeding only the better grades of screenings is one of importance. If wheat screenings of the poorest quality are the food of fowls for any considerable time, they will dwindle in size and may even starve to death. Wheat screenings as a food for poultry should be used in connection with an animal food and corn.

28. Wheat Bran.—The amount of gluten contained in **wheat bran,** which is a by-product in the manufacture of flour, determines its value as an egg-producing food. If the bran has the appearance of being kiln-dried, it probably contains so little digestible material that it is worthless as a food for hens. As dry bran free from gluten is practically all crude fiber, it is valuable only as a bulky substance for distending the intestines so that concentrated foods may be digested.

29. Middlings and Shorts.—The names **middlings** and **shorts** are indefinite terms for by-products derived in the manufacture of flour. Wheat middlings are made from the membrane that lies between the outer shell and the starchy interior of the wheat kernel; they contain some gluten, a substance composed largely of protein. Shorts as usually sold are made up of small, or ground, bran and wheat sweepings. Although wheat middlings are made up mainly of the fine bran that comes next to the starch in the wheat grain, they also contain gluten and some flour, and when finely ground are used to mix with flour for making coarse bread. Thirds, or fine shorts, are middlings of good quality. Middlings, as a rule, contain less crude fiber and more gluten than does bran. Because of the gluten they contain, they adhere to other meals when mixed as mush; middlings are worth more than bran and are much used in making dry-mash rations.

30. Flour.—When it can be cheaply obtained, the lower grade of **dark flour** is sometimes used for feeding poultry. This flour is rich in protein and other food principles, and can be mixed with middlings and corn meal. The resulting mixture may then be baked like bread and fed to young or growing chicks. A small portion of this flour mixed with mash forms a crumbly mass.

OATS

31. **Whole Oats.**—In weight and in other indications of value **whole oats** vary greatly; hence, it is exceedingly difficult to determine their value by their appearance. Some oats are two-fifths husks, which are of no value as food. The weight of oats varies from 25 to 50 pounds per bushel. Light oats are unfit food for fowls, while heavy oats with full, plump kernels are one of the very best. Good oats rank next to wheat as a poultry food, the one objection to them being the hulls, or husks, which are indigestible. Light-weight oats swell and clog in the crop and much energy is expended by the fowl in digesting them. Hulled oats are preferable for all feeding purposes, at least as far as poultry is concerned. If these oats are not obtainable, heavy-weight clipped oats should be used. Both whole and ground oats of the best quality are excellent foods for poultry, but little good is accomplished by the use of poor oats.

32. **Oatmeal and Hulled Oats.**—In the manufacture of both **oatmeal** and **hulled oats,** which have the same nutritive ratio, the hulls are removed; consequently, the food value of both oatmeal and hulled oats is greater than that of whole oats. Oats thus prepared are extensively used in making rations for young or growing chicks. Whole oats have a nutritive ratio of 1 to 6; hulled oats and oatmeal, 1 to 4. From this it will be seen that the prepared oats are better than whole oats as food for young chicks and laying hens. In fact, they are among the very best of the single-grain rations for fowls or chicks.

33. **Oat Hulls.**—The use of **oat hulls** as a poultry food should be discouraged. Apart from their value as manure, which is small, they are worth no more than sawdust. Ground

oat hulls are liberally used as an adulterant to lessen the cost of other foods and the presence of much of this adulterant may so reduce the value of the food as to make it useless to the fowls.

CORN

34. Whole Corn.—The structure of the **corn** kernel is similar in a general way to that of the wheat grain. Corn is the grain that is ordinarily the most attractive to poultry. If a mixture of grains containing some corn is cast on the ground, the fowls will eat the corn before they eat any of the other grains. The color, shape, and food value seem to be the qualities of the grain that attract the fowls. A preference by the fowls for any special grain, however, is an acquired habit; fowls that have grown to maturity without having seen corn do not have this preference until they have become accustomed to it. Some corn is almost a necessity for successful poultry feeding, while an all-corn ration is injurious because it is too fattening. Corn alone, however, will not fatten a fowl in the best way, nor will it produce a good yield of eggs. As shown in the tables, corn is rich in carbohydrates and fats; it provides heat for the body, and oil and fat for the feathers, for the yolk of the egg, and for flesh. Corn contains too little protein and ash for successful egg production, and it must be combined with other grains to produce the best results. A balanced ration can be formed by the use of corn and some other grains and meat.

35. Corn Bran.—The outside of the grain, or the shell, from which **corn bran** is made, is removed from corn when it is made into food products for human beings. This shell is hard and dry and has almost no food value, being composed almost entirely of indigestible fiber and a little ash. Corn bran should be omitted from poultry rations.

36. Gluten Meals and Feeds.—In making corn starch, the different parts of the corn grain—hull, germ, gluten, and starch—are separated from one another. The starch is, of course, kept by itself, but the other products are either mixed together or sold separately. The gluten is sometimes sold as **gluten meal,** and is a very important food for dairy cows. Good gluten meal that does not contain corn hulls, germs, or other waste products may also be used as a part of the meal ration for poultry. Gluten meal is a concentrated food, rich in protein, nearly all of which is digestible. Not more than 10 per cent. of a ration should consist of this meal. The germ of the corn is rarely sold separate from the other by-products. Like gluten meal, it should be fed sparingly to fowls. **Gluten feed,** which is much more commonly sold than either gluten meal or the corn germs, is made by grinding the germs, hulls, and gluten together. Gluten feed, although not so rich in protein as either the gluten meal or corn germs, should not be fed too liberally to poultry.

37. Hominy Chop.—Hominy is made from the hard or flinty part of corn. The hulls, corn germs, and some gluten left after the hominy is made, are ground into coarse meal and sold as **hominy chop,** which, if of good quality, is fully equal in value to corn meal as a poultry food. Like the value of all grain by-products, the value of hominy chop depends on its quality, and it should not contain too much crude fiber.

38. Corn Cobs.—The coarse meal made from **corn cobs** cannot be prepared in any way that fits it for food. It has about the same chemical composition that straw does, and as food for poultry both corn cobs and straw are valueless.

MISCELLANEOUS GRAINS AND SEEDS

39. Kaffir Corn.—Both **Kaffir corn,** or **dari,** and broom corn belong to the sorghum family of plants. The fact that Kaffir corn is used largely as food by people of Africa and in other countries is evidence of its nutritive value, Kaffir corn being, in this respect, about equal to barley or buckwheat. Kaffir-corn grains are very hard; tests made by feeding old, very dry grains to fowls show that many of them passed through the fowls without being broken up. The same grains resisted for a time an effort to soften them by boiling. When broken into bits, however, the small pieces could be eaten and digested by young chicks. In some localities where bugs and worms are plentiful, the entire grain ration for the summer months is Kaffir corn, a plentiful supply of insect food with this kind of grain making a nearly balanced ration. Kaffir corn can be used with safety in the ration for full-grown fowls, and if broken into small pieces, for chicks as well.

40. Broom Corn.—The seed of **broom corn** as a food for poultry is about equal in value to sunflower seed. Broom corn should be fed sparingly; a ration containing more than 10 per cent. of this grain cannot be fed with safety to the fowls. In order to avoid fermentation and mildew, the heads of the grain should be spread out and kept in a dry location. Ptomaine poisoning is liable to be produced by the eating of moldy grain or seed of any kind.

41. Rye.—The use of **rye** as a food for poultry should be avoided; the fowls do not relish it and bad results may come from its use.

42. Barley.—The grains of **barley,** if plump and of good quality, contain almost as much protein as oats, more than corn, and more of the carbohydrates than oats but not so much as corn. Good barley is about 15 per cent. hulls; poor barley may have a much larger per cent. of hulls and the grains themselves may be so shriveled as to be valuless as food. Good barley meal is useful for forming a portion of a meal ration for fattening fowls. It is one of the best meals for this purpose; but the ordinary barley meals are apt to be made of a mixture of barley and waste products, which tend to deprive the meal of its feeding value.

43. Buckwheat.—Fowls have to acquire a taste for **buckwheat;** they are not naturally fond of it, and as the hull, which forms a large percentage of this grain, is indigestible, it should never be used as a single-grain ration. Buckwheat whitens the flesh and improves its flavor when fed liberally to fowls. The yolks of eggs from hens fed freely on buckwheat are light in color. Although a small portion of buckwheat may be used as a part of an all-grain ration, it is not classed as a desirable grain for fowls.

44. Buckwheat Middlings.—The hulls of buckwheat have no feeding value, but in some localities they are used as litter in buildings and brooders. **Buckwheat middlings** are superior to wheat bran, and wheat middlings as a food for fowls, and this fact brings into the market buckwheat bran, which is largely broken hulls mixed with buckwheat middlings. Although the floury middlings of buckwheat are fit for poultry food, the bran of this grain is useless for this purpose.

45. Peas.—Although fowls relish pea vines, they must acquire a taste for the **peas** themselves, which are very good food. The field pea, or Canada pea, as it is sometimes called, is largely used as food for pigeons, and on the whole is probably the best pea for other kinds of poultry. Low-priced, broken peas, if cooked, can at times be used to advantage. When they have been thoroughly softened by boiling, wheat bran is added to them to make a crumbly mass; a little flour put with the bran will help to make the mass stick together. A mixture prepared in this way is greedily devoured by hens, and is an excellent egg-producing ration. Pea meal is a concentrated food that should be sparingly used. Peas or pea meal added to a fattening ration improve the quality of the lean meat.

46. Beans.—As a food for poultry, **beans** are more nutritious than peas. Bean vines are not so well liked as the pea vines, nor will the fowls eat beans as long as they have other food before them. Soybeans contain much protein and ash; because of this fact they are valuable food for fowls. Beans should be boiled to a soft mush and mixed with corn meal and bran; this preparation makes an egg-producing ration. If sufficient corn meal is added, a fat-forming ration that will produce a good quality of table meat is made. Fowls are naturally attracted to a mixture of this kind. Like other cooked foods, boiled beans may be fed to fowls while warm, but never while hot.

47. Rice.—**Rice** is a fat-forming food that is little used for poultry. Small or broken rice, however, may be used in chick feed to advantage. Boiled rice is a good food for Bantams because it produces so little bone and size; it satisfies hunger but does not produce growth to any extent. It is an expensive food for fowls.

48. Millet.—The seed of the foxtail **millet** is a rich grain that should not be fed liberally to poultry. When thrown into litter, the small, bright-colored seeds attract the fowls. A ration made up entirely of millet will destroy young chicks and injure old fowls. This seed is used to a limited extent in chick feeds, and also in scratching foods for hens. Millet is a fattening food and when hard, dry millet seed is liberally fed, it may clog the intestines or pass through them undigested.

49. Sorghum Seed.—The food value of the seed from sugar-producing **sorghum** is about equal to that of the seed of broom corn, but sorghum seed is more fattening than the broom-corn seed, and contains a little less protein than that seed. Sorghum plants that make good green food for fowls may be grown from sorghum seed sown broadcast or drilled into the ground.

50. Sunflower Seed.—**Sunflower seed** has a nutritive ratio of 1 to 7, about the same as wheat; but the digestibility of sunflower seed has not yet been accurately determined. It is likely that the larger portion of sunflower seeds are indigestible. The kernels have a pleasant flavor and contain considerable fat, but when dry and shriveled their food value is small. Fresh, plump sunflower seeds can be used to advantage by sparingly feeding them to fowls in molt; if these seeds are liberally fed, the digestive organs of the birds soon become clogged with indigestible fiber.

51. Flaxseed.—Of all the grains and seeds fed to poultry, **flaxseed** is the richest in oil and protein. Its use is seldom necessary, because equal benefit can be derived by using by-products of seeds that are much less expensive. Flaxseed is a laxative, but contains so much gluten that it may clog the passageways of the digestive organs.

52. Linseed Meal.—There are two kinds of **linseed meal**—old process and new process. The latter meal contains less protein and is more fattening than the former. There is very little old-process meal made at the present time. Linseed meal contains the feather-forming elements to a large extent and is valuable during molt; it can be cautiously fed at all times. Fowls do not favor it as a food; it is laxative, concentrated, and contains so much gluten that it will clog up the crop if used too liberally. The quantity of linseed meal used should not exceed 5 per cent. of the entire ration.

53. Cottonseed Meal.—Even when fed sparingly, **cottonseed meal** is not relished by the fowls. Neither cottonseed nor any of its products should ever be fed to fowls, as these foods act as irritants to the digestive organs, and if fed liberally cause death.

54. Peanut Meal.—Meal made from **peanuts** after the oil has been extracted is a good food for poultry. It is a palatable food and can be used in small amounts with other fattening meals. An ounce and a half of peanut meal has about the same food value as 1 ounce of the best meat scrap. There is so little of this meal that it cannot often be used profitably as food for poultry.

55. Hemp Seed.—**Hemp seed** contains more fat and less fiber than sunflower seed; for this reason, hemp seed is more easily digested and gives better results than sunflower seed does. Hemp seed, which is a stimulating, fat-forming food, should be fed in small quantities and only to fowls that are slow to molt. A small quantity of this seed can also be fed to exhibition fowls during the cold weather to improve the gloss on their plumage.

56. Canary Seed.—The best known balanced ration for cage birds is **canary seed;** young chicks also enjoy a little of this seed, on which they will thrive when they do not do well on other grains. All waste canary seed should be fed to the chicks, but this feed is too costly to use except in an emergency or to save the waste from cage birds.

57. Rape Seed.—The German **rape seed, or bird-seed rape,** is a better food than millet seed for young chicks. It is a fattening food, rich in protein, and is dark or chestnut brown in color. Rape-seed grains are smaller than millet seeds. For ailing or weakly chicks, the rape seed should be boiled for 5 minutes, turned into a fine, funnel-shaped sieve, and left to drain over night. A small portion of this food should be given in the morning and evening. Only the true German rape seed is fit for this use.

VEGETABLES

58. Mangels.—Of all the vegetables and roots that are fed to poultry as substitutes for green foods, **mangels** are the best; they are fine-flavored, sweet, and nutritious, and impart these qualities to the meat and eggs of the fowls. No objectionable flavors are introduced into either the flesh or the eggs as a result of feeding mangels liberally. Mangels are rank growers, keep well throughout the winter if protected from frost, are easily fed, and are freely eaten by the fowls.

59. Beets.—There are many kinds of **beets,** all of which are eaten freely by poultry. If too many raw beets are fed, however, the bowels of the fowls may become so loose that diarrhea will result, especially if the use of beets is long continued. Raw beets should be sparingly fed, but if they are cooked they make a valuable addition to a ration.

60. Turnips.—As a poultry food, **turnips** are not so desirable as beets. If turnips are fed raw, they taint the flavor of the eggs and do not improve the meat of market poultry. The rutabaga is the best variety of turnip for poultry, but even this turnip will taint the eggs if fed to any extent. Turnips, parsnips, and carrots, when boiled to a pulp and mixed with the mash feeds, make good rations for all kinds of poultry. A very little salt should be put in the water in which the vegetables are boiled. Too much salt will kill poultry; fowls require much less salt than men.

61. Potatoes.—If they are plentiful and cheap, **potatoes** may be used as poultry food; 5 pounds of potatoes are about equal in feeding value to 1 pound of corn meal. Potatoes fed to laying hens should be thoroughly boiled, drained, and mixed with wheat bran, middlings, and ground oats; the same mixture will do for growing chicks, but if it is to be used for fattening purposes some corn meal should be added to this ration. Meal that is made from small potatoes can be used as a fattening food; this meal contains all the solid food of the potato and only a small per cent. of the original moisture. The meal is an easily digested food, and it is used where potatoes are more plentiful than grain. Raw potatoes are not fit food for poultry.

62. Onions.—Although **onions** are wholesome food for all kinds of fowls, their flavor is imparted to the eggs and meat of the fowls that eat them; for this reason onions should not be used when their flavor will prove objectionable. Turnips, onions, and potatoes may be boiled together and used in mash food for all kinds of poultry without harm, provided none of the mixture is fed for 2 weeks before killing the fowls for market or selling their eggs for food. All of these vegetables can be safely used for hens when their eggs are to be used for hatching and not for food.

63. Cabbage.—Although not the best thing for them, **cabbage** is a favorite food of fowls and is often quite liberally fed. Cabbages are laxative, especially when they have been frozen. They also impart an odor to eggs that detracts from their quality. If cabbages are permitted to freeze and are carelessly fed they may reduce the egg yield materially, and may also cause so much looseness of the bowels of the fowls that their health will be injured. Kale and Swiss chard can be used in the same way that cabbages are.

GREEN FOODS

64. Green, or growing, plants are valuable as food for poultry on account of the natural juices they contain. The tender blades of grass and other forage plants impart new life to fowls that feed on them in the spring. There is a principle in this kind of food that cannot be described as other than Nature's life giver or cure for the debilitated condition resulting from winter privations and confinement of the fowls. Hens that fail to produce an egg during winter months, brighten up in color of eye, face, and comb and begin to lay with the return of spring and a natural supply of green food. Geese will gather their entire living, produce eggs, and rear their young on the range, provided there are sufficient growing plants and an abundance of water. The eggs and the meat of all kinds of poultry are more palatable after the use of green food in the spring than they are during the winter period. Not only are the eggs more palatable but they are also more fertile, and the chicks hatched from them are more vigorous. Chicks can be grown and fowls sustained without green food, but the difference between those that have it in abundance and those that do not is so marked that all question of its value is removed. It is not always possible to provide poultry with green food, but good results may be obtained by substituting clover hay or other dried forage for the green portion of the ration. This practice is necessary where the fowls cannot range extensively and whenever there is no available green food owing to climatic or other conditions.

The green food consumed by fowls or chicks should not be considered as a regular portion of the nutritive ration, but rather as a supplement to the grain and animal food. Some green food should be fed every day, for if it is irregularly fed the fowls may gorge themselves on it. The yield of eggs is thereby lessened and looseness of the bowels frequently follows. Fowls will not eat too much green food if the daily supply equals their needs. If green food is not always before them it should follow their morning ration.

Green food is at its best when gathered by the fowls from the field where it grows. No other way of feeding equals that of grazing from the fields. If this method is not practicable, the green food should be cut into pieces similar in size to those picked from the plants by the fowls. Another way of feeding green food is to tie tightly the long grass, clover, or other plants into bundles and suspend them so the fowls can pick at them. By proceeding this way the fowls will obtain their green food in a natural manner and all danger of the tainting of the food by the soil will be removed. The usual method of throwing the forage loose on the ground is wasteful, as the greater portion is lost by being scattered about and by being withered into uselessness.

65. Vegetable Tops.—Poultry relish the **tops of vegetables** as green food. Trimmings from vegetables and the waste from fruit, cabbage, and roots, cut into small pieces, boiled to a pulp, and mixed into a mash of meal, make an excellent food for all kinds of fowls, both old and young. Clippings of grass from the lawn are also good food for poultry that is confined in yards; or, if dried and stored, these clippings will be good for winter use. Either fresh or dry, they are valuable as litter for the floor of the brooder or brooder house.

66. Grass.—Nearly everywhere **grass** of many kinds grows naturally or is cultivated for feeding, grazing, and hay making, and none of the green foods is better for poultry. Where grass is naturally abundant, a supply of green food is always at hand during the growing season. But green food for winter use must be grown and stored, and in some places the supply for the entire year must be grown.

67. Fodder Corn.—Corn that is sown broadcast or drilled in rows produces tender, green stalks called **fodder corn,** which is relished by fowls that are confined; it is not preferred by fowls having their freedom, nor should it be fed after it has passed beyond a succulent or juicy condition.

68. Alfalfa and Clover.—The tender leaves of all the **clovers** and of **alfalfa** are in much demand by fowls. They probably prefer alfalfa, or lucerne, as it is also called, to clover. After it has become well established, alfalfa will continue to grow for many years and will produce heavier yields of green forage and hay than any of the clovers. To raise alfalfa successfully, the soil must be adapted to the needs of the plant, and in many localities clovers can be raised more easily than alfalfa.

69. Green Crops for Winter Feeding.—Turnips, beets, or other crops to furnish green food for the winter may often be grown in the rows of corn. The seeds for these plants should be sown at the last cultivation of the corn. All products that are suitable for poultry are also proper food for dairy animals. Fields are sown with rye for the hens to graze over, or the growth is cut for feed during the winter and early spring. A mixture of oats, peas, rape, and clover makes a good forage crop for fowls. In planting the crop, a thin seeding of oats and peas are first harrowed into the ground and the clover and rape are then sown; 3 bushels of oats and 2 bushels of peas is a fair proportion, and 1 quart of German rape seed with 6 quarts of clover seed is used for seeding over the oats and peas. Clover of all kinds, Canada peas, cowpeas, oats, sorghum, millet, and rape are all grown and cut for poultry feed while short and succulent. All these products that are suitable for poultry are proper foods for dairy animals and are used for both cattle and poultry. Lettuce, kale, Swiss chard, beets, potatoes, and cabbage can be planted in the garden or along the fence line of the fields and the surplus leaves and tops fed to old and young fowls of all kinds.

70. During winter months, **clover hay** can be used as a substitute for green food. Hay made from red clover is most frequently used for this purpose, although hay made from any of the clover plants is good winter food for fowls. It may be used as litter on the floor, from which the fowls will help themselves, or the hay may be cut into small pieces

TABLE IV

COMPOSITION AND NUTRITIVE RATIO OF GREEN FOODS

Food	Dry Matter Per Cent.	Digestible Nutrients			Nutritive Ratio
		Protein Per Cent.	Carbo-hydrates Per Cent.	Fat Per Cent.	
Alfalfa	20.0	3.7	7.3	.6	1 : 2.4
Alfilerilla	20.0	2.1	8.5	.7	1 : 4.8
Barley	21.0	1.9	10.2	.4	1 : 5.8
Red clover	29.2	2.9	14.8	.7	1 : 5.7
Crimson clover	19.3	2.2	9.3	.4	1 : 4.6
Corn	20.7	1.0	11.6	.4	1 : 12.5
Cowpeas	16.4	1.7	8.8	.3	1 : 5.6
Blue grass	34.9	2.7	17.8	.7	1 : 7.2
Hungarian grass	28.9	1.9	15.6	.4	1 : 8.7
Orchard grass	27.0	1.9	15.9	.6	1 : 9.1
Oats	37.8	2.4	17.9	.9	1 : 8.3
Rye	23.4	2.5	14.1	.4	1 : 6.0
Rape	14.3	2.2	8.6	.3	1 : 4.2
Red top	34.7	2.6	21.2	.6	1 : 8.7
Soybeans	28.5	2.8	11.8	.6	1 : 4.7
Timothy	38.4	2.1	21.2	.6	1 : 10.8
Kaffir corn	27.0	.8	13.8	.4	1 : 18.4
Lettuce	4.1	1.0	2.7	.8	1 : 4.5
Artichokes	20.0	2.0	16.8	.2	1 : 8.7
Beets	15.7	1.6	11.9	.1	1 : 7.6
Beet leaves	11.3	1.7	4.6	.1	1 : 2.8
Cabbage	15.3	1.8	8.2	.4	1 : 5.1
Carrots	11.4	.8	7.8	.2	1 : 10.4
Mangels	9.1	1.1	5.4	.1	1 : 5.1
Parsnips	11.7	1.6	11.2	.2	1 : 7.3
Potatoes	21.1	.9	16.3	.1	1 : 18.3
Pumpkins	9.1	1.0	5.8	.3	1 : 6.5
Rutabagas	13.0	1.2	7.5	.2	1 : 6.7
Sweet potatoes	19.7	1.5	24.7	.4	1 : 17.1
Turnips	9.5	1.0	7.2	.2	1 : 7.7
Apples	15.9	.4	14.2	.3	1 : 37.3
Onions	12.4	1.4	9.4	.5	1 : 7.5

and placed in a box for the fowls to work over. They eat all the leaves of clover hay. Bright, clean, early cut hay is preferable to a dark hay made from cured plants. Ground clover and clover meal may also be used as food for poultry.

71. Hay made from **alfalfa** is extensively used for poultry, and it may, like clover, be cut into pieces or ground into a fine meal before feeding. All forms of alfalfa are freely eaten both by old and young fowls, and alfalfa is not equaled by any other hay as a substitute for green food for fowls. Meadow hay may be ground and mixed with alfalfa meal, but alfalfa is best fed without mixture or adulteration.

72. Analyses of Green Foods.—Table IV shows the analyses of the more common green foods suitable for poultry. A careful study of this table shows a great variation in nutritive ratios of the various green foods. Alfalfa, which has a very narrow ratio, contains less nutrition than red clover, which has less protein but more fattening material. The value of timothy grass as a poultry food is not equal to that of blue grass, nor is any kind of corn forage as good as barley, rye, oats, or rape. The green vines of peas and beans are nearly equal in value to corn, but they are not so well liked by the fowls. All the roots except sweet potatoes, white potatoes, and carrots are nutritious foods; when cooked, these vegetables are good for mixing with bran and middlings as a mash. Of all the roots, *white* mangels are the best for feeding raw to poultry; they are delicate in flavor, sweet to the taste, and are relished by the fowls and can be grown in any locality where roots will thrive. When the mangels are harvested, the tops should be left evenly scattered over the field to preserve the fertility of the soil, for they contain more plant food than do the roots.

ANIMAL FOODS

MEAT AND MEAT PRODUCTS

73. Insects and **worms** form an important part of the food of wild birds and of our domestic fowls whenever they are permitted to range. Marked success in producing eggs and in growing poultry for the market cannot be obtained without the use of some animal food.

74. Lean Meat.—Meat is an acceptable substitute for insects and worms. **Lean meat** is especially useful in the feeding of laying hens, for by using this food much protein may be added to the ration without increasing its bulk or using concentrated foods that impair digestion. The carcasses of horses and cows are composed mainly of lean meat and can be used as poultry food.

75. Meat Scraps.—There are two kinds of **meat scraps,** fat and lean. The latter kind contains twice as much protein as carbohydrates, while the former contains more fat than protein and very little ash. The best lean-meat scraps should be selected for laying hens; the more protein and the less fat the scraps contain, the better they are for the hens. Only good meat scraps should be used. To test their palatability, some of them should be put into a cup and boiling water should then be poured over them. If the odor that comes from the cup is not objectionable, the scraps are good for poultry food; if the odor is putrid, the scraps are valueless as food, and if fed to laying hens the bad odor will be transmitted to both the eggs and flesh. The flesh of broilers and young fowls can be ruined for table purposes by the use of putrid food. Fat-meat scraps and fat or tallow may be used in fattening special grades of table poultry.

76. Animal Meal.—Some of the numerous by-products of the slaughter houses are very concentrated foods and are very rich in protein. The value of these foods is based entirely on the amount of protein they contain, and their fitness for food depends on their being high in protein, low in fat, sweet and palatable in taste. The feeding value of **animal meal** is higher than that of cut green bone; but better results are obtained from the use of cut green bone than from animal meal, because the former contains a larger per cent. of ash than of protein—presumably because the meal is made from both bone and meat. Good meat meal is rich in protein but contains less ash than animal meal, and can only be used sparingly in making an egg-producing ration. Because of its cost and richness in protein, meat meal is used only when good meat scraps cannot be obtained.

77. Dried Blood.—**Dried blood** and **blood meal** are sometimes used to supply protein in foods for poultry. These blood products are concentrated foods and a small amount of either mixed with other foods will make a narrow ration. Dried blood and blood meal are not generally economical nor profitable foods for poultry.

78. Cut Green Bone.—The food commonly called **cut green bone** is made by cutting fresh bones into small pieces by means of a bone mill. Being fresh meat, bone, and fat, its composition closely resembles that of bugs and worms, the natural food of fowls. If a proper amount of cut green bone, not more than ½ ounce per day for each fowl, is mixed with wheat bran, a balanced ration will be formed. The greater portion of the meat and fat and some of the bone in this ration can be assimilated; this stimulates the egg-producing organs and assists them in the secretion of albumen and shell. Tainted meat that is not fit for human food should not be fed to fowls. The taint of such food may sometimes be removed by boiling it in water containing baking soda, in which case the meat can be safely fed to fowls.

79. Bone Meal.—Bones of animals may be cleaned of all meat, fat, and marrow, reduced to meal, and used to supply any deficiency of lime, ash, or bone-forming material that exists in the ration. **Bone meal** can be fed to young chicks to produce a strong growth of bone. The particles in this meal vary in size from those that are very small to those of the size of whole wheat or even corn; the largest sizes are not desirable for poultry food.

80. Fish.—Fish that are handled for their oil are reduced in presses until little of their flesh remains. The bone and other residue are then ground into a meal. This **fish meal** and **dried fish** are sometimes fed to poultry. Fish products are liable to transmit a disagreeable flavor to the eggs or meat, and for this reason are not desirable.

81. Preservation of Meat.—There are many methods of preserving meat. In districts where freezing weather continues throughout the winter, the carcasses of animals killed for poultry food may be quartered and the quarters permitted to freeze. When in this condition, meat may be kept fit for food for many weeks. Lean meat and cut green bone may also be preserved by means of lime and meal; in this case the meat is first cut into small pieces with the bone mill and is then spread on a clean floor where there is a good circulation of air but not in the direct rays of the sun. Four ounces of salt should then be applied to each 50 pounds of meat, care being taken to have the salt evenly distributed. The salted meat is next sprinkled with slaked lime and the mass thoroughly mixed with a garden rake until the surface of each pile of meat is covered with lime. Enough corn meal to absorb all the moisture is now added and the mass is permitted to dry, being frequently stirred with the rake. Meat treated in this way will keep for many weeks, provided it is kept in a dry place out of the reach of flies and other insects.

82. Selection of Animal Food.—The value of meat for poultry food depends mainly on its protein content, palatability, and flavor. Although some animal foods contain much ash or mineral matter, they should not be selected primarily for this reason, as the necessary amount of ash may be more cheaply obtained by the purchase of shells or grit. Meat scraps containing more than 60 per cent. protein are worth more than twice as much as those that contain but 30 per cent.

MILK

83. Milk is of more value as a poultry food than its chemical analysis indicates. In fact, nothing excels warm milk direct from the cow as the first ration for chicks. In spite of this fact, it will not generally prove profitable to use milk as chicken food, for even when carefully handled it is not worth more than 2 cents per quart for this purpose. Table V shows the composition of milk and various milk products.

TABLE V

COMPOSITION AND NUTRITIVE RATIOS OF MILK AND MILK PRODUCTS

Food	Water Per Cent.	Ash Per Cent.	Protein Per Cent.	Carbohydrates Per Cent.	Fat Per Cent.	Nutritive Ratio
Whole milk...	87.2	.7	3.6	4.9	3.7	1:2.4
Skim-milk....	90.6	.7	3.3	5.3	.1	1:1.9
Sour milk	90.6	.7	3.3	5.3	.1	1:1.9
Cottage cheese (milk curds)	72.0	1.8	20.9	4.3	1.0	1:0.3
Buttermilk ..	90.3	.7	4.0	4.5	.5	1:1.4
Whey........	93.4	.5	.8	5.0	.3	1:7.0

Profitable results cannot be obtained from fowls when they are fed on milk alone, but it can be successfully used for moistening their mash foods. If used in this way, it will increase the quantity of eggs and improve the quality both of eggs and of the flesh of the fowls. Skim-milk, sour milk, and buttermilk are improved for this purpose by scalding, not boiling, for boiling destroys their value and palatability. The whey of the milk is of no value as poultry food.

84. Whole Milk.—There is more fat and protein and less carbohydrates in **whole milk** than in skim-milk. While the former is a better food than the latter, the fat contained in it is more valuable for purposes other than poultry food. If not properly handled, milk fed to poultry may produce harmful results. If fed as a slop in troughs or pans, the fowls will scatter it over the ground and on their plumage. The soil and feathers thus become tainted and serve as breeding places for disease germs.

85. Skim-Milk.—Relatively more protein is contained in **skim-milk** than in whole milk, and, all things considered, skim-milk is a better poultry food. Some sour skim-milk is really more digestible than the sweet milk, the acid in it apparently promoting digestion. Sweet skim-milk is, however, preferable to the sour when moistening the feed for young and growing chicks. Before being used for this purpose, the skim-milk should be warmed, not boiled, as warming the milk prevents fermentation and aids digestion, thereby obviating much bowel trouble. Sour skim-milk is especially good for fattening fowls for market, but should not be used for this purpose for too long a time.

86. Cottage Cheese.—The curds of sour milk when separated from the whey are known as **cottage cheese.** This cheese is made by warming the sour milk, which causes the whey to separate from the curds. The mass of curds and whey is then placed inside a cotton bag and the whey permitted to drain away; the curds collect in a floury mass, which is known as cottage cheese. It may be sparingly fed to all kinds of poultry; if fed liberally, especially to young birds, it is likely to cause death by obstructing the bowels. A pint of cottage cheese per day is all that twenty grown fowls should ever receive.

MINERAL MATTER

87. Grit.—The food eaten by fowls, as has been said, goes first into their crop, where it is softened by water; it then passes into the gizzard, and by the action of small sharp stones or **grit** is there ground into a pasty mass. Fowls that have free range can sometimes obtain enough **grit** from the range, but it is always well that they have an artificial supply available; such a provision is an absolute necessity for confined fowls. The best grit is sharp, irregular pieces of hard limestone about the size of corn kernels. The continuous rubbing of the grit particles against one another within the gizzard wears them smooth and a portion of the mineral matter is assimilated and the remaining parts pass away in the excrement.

It is obvious that mineral matter is necessary for the good health of the fowls and for eggshell forming material. The lack of a sufficient amount of this in the regular ration may be supplied in shell, grit, and other material. Particles of lime, plaster, or shells are picked up by the fowls; broken oyster shells, or shells of any kind are the best material for the purpose. Granulated bone and bone meal serve the purpose fairly well, but the lime in shells is more quickly dissolved by the action of grit and gizzard and hence is better than the bone.

88. Charcoal.—Charcoal is one of the necessities of poultry feeding and should be kept constantly before poultry; it assists digestion, sweetens the crop, gizzard, and intestines, and prevents ailments of the digestive tract. The charcoal, which should be broken into small pieces, should be supplied with the oyster shells and grit.

POULTRY FEEDING

(PART 2)

RATIONS

PREPARATION OF RATIONS

1. Kind of Food.—The kind of food needed in a ration differs with the age of the fowls and with the purpose for which they are kept; to grow young chicks rapidly requires plenty of protein for blood, flesh, and feathers; and to produce eggs, the hen must have also nitrogenous food and plenty of mineral matter; to fatten the fowls, foods rich in the fat-forming principles must be used.

A good ration for any particular purpose contains the proper quantities of digestible protein, carbohydrates, and fats necessary to furnish the desired results. If a wide, or fattening, ration is fed to hens for the purpose of producing eggs, it will fail of its purpose, for this kind of food lacks the constituents that produce eggs.

2. Value of Foods.—In computing the value of foods, the digestible portion only is considered. As previously stated, crude fiber, though indigestible, is of vital importance to the fowl, but no more than is contained in the foods best suited for the natural demands of the fowl should be used. Therefore, in selecting oats or any other grain encased in shucks, all the attention is given to the food value of the grain itself and not to the shucks, which are really of no more value than so much straw. As has been said, the most

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TABLE I

PERCENTAGE OF FOOD PRINCIPLES, NUTRITIVE RATIO, AND MANURIAL VALUE OF POULTRY FOODS

Food	Dry Matter Per Cent.	Ash or Mineral Matter Per Cent.	Protein Per Cent.	Carbohydrates and Fats Per Cent.	Nutritive Ratio	Manurial Value per 100 Pounds (Dollars)*
Whole-Grain Foods:						
Flaxseed	90.8	4.3	20.6	82.3	1 to 4.0	.657
Beans	87.0	2.6	17.0	50.8	1 to 3.0	.541
Peas	90.0	2.6	16.8	53.4	1 to 3.3	.548
Hemp seed	87.8	4.3	16.3	96.9	1 to 5.9	
Canary seed	86.4	2.1	13.5	61.7	1 to 4.6	
Sunflower seed	92.5	2.6	12.1	85.8	1 to 7.1	.428
Wheat	90.0	1.8	10.2	73.0	1 to 7.2	.426
Rye	88.0	1.9	9.9	70.0	1 to 7.1	.329
Wheat screenings	88.4	2.9	9.8	55.9	1 to 5.7	.462
Oats	89.0	3.0	9.2	56.8	1 to 6.2	.378
Millet	86.0	3.3	8.9	52.2	1 to 5.9	.365
Barley	89.0	2.4	8.7	69.2	1 to 8.0	.288
Corn	89.0	1.5	7.9	76.4	1 to 9.7	.826
Buckwheat	87.0	2.0	7.7	53.3	1 to 6.9	.247
Kaffir corn	84.8	1.5	7.8	63.2	1 to 8.1	
Broom corn	85.9	3.4	7.4	54.8	1 to 7.4	.244
Sorghum seed	87.2	2.1	7.0	59.1	1 to 8.4	.281
Rice	87.6	.4	4.8	72.9	1 to 15.2	.175
Meals and Hays:						
Old-process oil meal	91.0	5.3	29.3	48.5	1 to 1.7	.960
Gluten meal	92.0	.8	25.8	65.6	1 to 2.5	.774
Buckwheat middlings	87.0	4.8	22.0	45.6	1 to 2.1	.256

Gluten feed	92.0	1.1	19.4	63.3	1 to 3.3	
Coconut-oil cake	86.0	4.7	16.4	64.8	1 to 4.0	
Wheat middlings	88.0	3.8	12.8	60.7	1 to 4.7	.471
Wheat bran	88.0	5.8	12.2	45.3	1 to 3.7	.618
Alfalfa hay	92.0	7.4	11.0	42.3	1 to 3.8	.431
Hominy chop	89.0	2.5	7.5	70.5	1 to 9.4	.316
Corn bran	90.9	1.2	7.4	70.1	1 to 9.5	.335
Red clover hay	85.0	6.2	6.2	39.6	1 to 6.4	.329
Oat hulls	90.6	6.7	1.3	41.5	1 to 31.9	.113
Animal Foods:						
Meat scraps (lean)	89.3	4.1	66.2	31.1	1 to 0.5	1.750
Meat scraps (fat)	94.6	1.5	53.0	68.0	1 to 1.3	
Dried blood		4.7	52.3	5.6	1 to 0.1	2.128
Dried fish		39.2	44.1	23.2	1 to 0.5	1.772
Animal meal		19.5	32.0	23.0	1 to 0.7	
Cottage cheese	29.0	.8	21.0	6.6	1 to 0.3	
Fresh meat	26.4		20.5	7.9	1 to 0.4	
Fresh-cut bone		11.5	18.0	43.0	1 to 2.4	
Yolk of eggs	47.0	1.0	16.0	67.5	1 to 4.2	
White of eggs	16.2	1.2	12.0	4.5	1 to 0.4	
Buttermilk		.7	3.9	6.5	1 to 1.7	.088
Skim-milk		.7	2.9	5.9	1 to 2.0	.103
Green Foods:						
Grass	24.7	2.0	3.5	15.5	1 to 4.4	
Red clover, green	29.0	2.1	2.9	16.4	1 to 5.7	.107
Cabbage	15.0	1.4	1.8	9.1	1 to 5.1	.082
Rape	14.0	2.0	1.5	8.6	1 to 5.7	
Mangel beets	13.0	1.1	1.1	5.6	1 to 5.1	.951
Turnips	9.5	.8	1.0	7.6	1 to 7.6	.050
Potatoes	21.0	1.0	.9	16.5	1 to 18.3	.075

*The values are relative.

important and valuable food principle is protein; next in value are the carbohydrates and fats. All the other constituents, so far as their money value is concerned, may be considered of minor importance. In fact, in compounding rations, only the protein and carbohydrates and fats are considered at all, for the ratio of these elements determines the nutritive content of the ration.

3. The nutrients that replenish the blood come from the digestible portion of the food, and only a small part of the matter that can actually be digested is assimilated by the fowl. In no single instance is the complete value of a ration ever extracted from it by the digestive organs of the fowl. Even the protein and soluble nitrogen-free extract are never completely digested. The indigestible portion of food has no nutritive value, and if excessive amounts of it are consumed serious results may follow. Because of this fact, a ration should be made up of easily digested foods. The value of a balanced ration should not be lessened by the presence of an excessive proportion of indigestible matter.

4. Balanced Ration.—A ration in which the protein and carbohydrates are present in the correct proportions for the purpose for which the ration is intended is said to be a **balanced ration.** In preparing such a ration, different foods are brought together to form a composite product of the proper nutritive ratio. Not only is loss incurred by feeding excessive quantities of food to fowls, but there is also loss if there is a surplus or a deficiency of one or more of the food principles. If corn alone is fed to hens they become excessively fat and do not produce eggs, much of the fat and carbohydrates of the corn being wasted in this case. If there is too much lean meat present in a ration, valuable protein is wasted, while if there is not enough nitrogen or protein present in the food of chicks they will not grow properly. To avoid these losses, balanced rations should be selected and fed wherever practicable.

5. Analyses of Poultry Foods.—Carefully prepared tables showing the chemical composition of many poultry foods can be safely used as guides in making or compounding rations for poultry. Table I shows the percentage of food principles, nutritive ratio, and manurial value of the poultry foods commonly used both in the United States and in England. In preparing this table, the amount of fat in each food was multiplied by 2¼, thus expressing the fat in terms of carbohydrates. The result obtained in each case was added to the amount of carbohydrates present and the sum stated in the table as carbohydrates and fats. It should be remembered that, while every effort has been put forth to make the table accurate, it is not infallible, because the composition of any food varies considerably. The foods are arranged according to their digestible protein content, the food richest in protein coming at the head in each division.

TABLE II

BY-PRODUCT RATION

Food Material	Quantity Pounds	Dry Matter Pounds	Protein Pounds	Carbohydrates and Fats Pounds
Alfalfa hay or meal	3	2.76	.33	1.27
Wheat bran	2	1.76	.24	.91
Wheat middlings	5	4.40	.64	3.04
Coconut-oil cake	2	1.72	.33	1.30
Lean-meat scraps	1	.89	.66	.31
Wheat	7½	6.75	.77	5.48
Total		18.28	2.97	12.31

6. Use of Table.—The use of the food table may be illustrated as follows: Required, the amounts of the food principles and the nutritive ratio of a ration containing 3 pounds of alfalfa hay, 2 pounds of wheat bran, 5 pounds of middlings, 2 pounds of coconut-oil cake, 1 pound of lean-meat scraps, and 7½ pounds of wheat. By referring to Table I, it is seen that alfalfa hay is 92 per cent. dry matter; therefore, the dry matter in 3 pounds of alfalfa hay is .92×3 =2.76 pounds. Similarly, the protein is .33 pound; and the carbohydrates and fats, 1.269 pounds. The contents of the other foods of the ration are found in the same way and the results to two decimal places are given in Table II.

TABLE III

COST OF PROTEIN IN POULTRY FOODS

Food	Price per Ton (Dollars)	Protein	
		Pounds per Ton	Price per Pound (Cents)
Skim-milk	4	66	6.0
Rice	30	106	28.3
Corn	30	156	19.2
Oats	30	184	16.3
Wheat	30	184	16.3
Broken crackers	26	190	13.7
Mixed feed	21	192	10.9
Barley	25	192	13.0
Rye	30	198	15.1
Rice bran	16	214	7.5
Wheat bran	21	224	9.3
Wheat shorts	22	244	9.0
Wheat middlings	27	244	11.0
Wheat, shrunken	29	264	11.0
Alfalfa hay	11	274	4.0
Alfalfa meal	22	274	8.0
Coconut-oil-cake meal	22	328	6.7
Beans		400	
Fresh meat		418	
Cottage cheese		518	
Linseed-oil-cake meal	27	522	5.2
Gluten meal	30	680	4.4
Cottonseed meal	30	822	3.6
Meat meal	60	1,080	5.6
Dried blood	60	1,440	4.1

This ration contains 2.97 pounds of digestible protein and 12.31 pounds of digestible carbohydrates and fats. As has been stated, the nutritive ratio is found by dividing the amount of the carbohydrates and fats by the amount of protein, and in this case the work is indicated thus, $12.31 \div 2.97 = 4.1$. Therefore, the nutritive ratio of this ration is 1 to 4.1, or it contains 1 part of digestible protein to 4.1 parts of digestible carbohydrates and fats, and has a narrow nutritive ratio.

With the exception of wheat, the above ration is made up of by-products, and illustrates the practicability of their use as food for poultry. The ration also contains as much oil-cake meal and meat as can be used with safety, and an excess of which is detrimental to digestion. All of this ration except the wheat can be used in mash.

7. Cost of Protein.—The value of protein for egg production makes its use imperative; and as protein is the most costly of all the food principles, care should be exercised in selecting the parts of the ration that are to furnish this principle. Table III shows the number of pounds of protein per ton and the cost of protein per pound in various common poultry foods.

8. Cost cannot entirely govern the selection of food material. Cottonseed meal provides protein at the least cost, but this must be fed with extreme caution on account of the bad results that follow its use as food for hens. Linseed meal, while high in food value, is laxative, and if liberally fed to the fowls, looseness of the bowels results. Alfalfa hay is a cheap source of protein, but a sufficient quantity cannot be consumed to provide the necessary amount. Protein from skim-milk is inexpensive, but a ton of the milk contains only 66 pounds of protein. On the other hand, 100 pounds of dried blood contains 72 pounds of protein. The selection of concentrated foods must be made for their adaptability as well as for the protein they contain.

9. Quantity of Food.—It is obvious that fowls of different sizes require different quantities of foods. Hens at rest, or non-layers, require less food than laying hens of equal size. Table IV shows the amount of the different food principles required daily for a maintenance ration for each 100 pounds of live weight of non-laying hens.

TABLE IV

STANDARD FOR MAINTENANCE RATION FOR HENS

Weight of Hens Pounds	Amounts per 100 Pounds of Live Weight					Fuel Value Calories	Nutritive Ratio
	Total Dry Matter Pounds	Protein Pounds	Fat Pounds	Carbohydrates Pounds	Ash Pounds		
5 to 7	2.70	.40	.20	2.00	.10	5,300	1 to 6.2
3 to 5	3.90	.50	.30	2.95	.15	7,680	1 to 7.4

10. Ration Standard.—The amounts of the different food principles indicated in Table IV will sustain life and maintain a healthy condition, but they will not furnish material sufficient to increase size or weight, to grow bone or feathers, or to produce eggs. To develop size and weight and produce a satisfactory yield of eggs, a closer or narrower ration must be fed; more of each element must also be provided.

TABLE V

STANDARD FOR RATIONS FOR 100 POUNDS OF LAYING HENS

Weight of Hens Pounds	Amounts per 100 Pounds of Live Weight					Fuel Value Calories	Nutritive Ratio
	Total Dry Matter Pounds	Protein Pounds	Fat Pounds	Carbohydrates Pounds	Ash Pounds		
5 to 8	3.30	.65	.20	2.25	20	6,240	1 to 4.2
3 to 5	5.50	1.00	.35	3.75	30	10,312	1 to 4.6

Table V, which may be considered a standard for rations for laying hens, shows the amounts of the various food principles required for each 100 pounds of live weight of hens that are laying well.

In accordance with Table V, one hundred light-weight laying hens, each of which weighs 3½ pounds, would require daily: Total dry matter, 19.25 pounds; protein, 3.5 pounds; fat, 1.23 pounds; and carbohydrates, 13.13 pounds.

11. In preparing rations for various purposes, enough grains and other foods are used to furnish the required amounts of digestive nutrients called for by the standards. These foods are judged according to the analyses given in the feed tables. Due consideration should also be given to the cost, palatability, digestibility, and the proportion of crude fiber in the food. The ration may contain all the nutrition that nature demands, but its surplus of fiber may prevent its satisfactory use as poultry food. To conform to the above standard, a ration for twenty-four laying hens may contain 3 pounds of cracked corn, 2 pounds of wheat, and 1 pound of beef scraps. This is 96 ounces, and furnishes 4 ounces of food to each hen; green food of some kind must be given with this ration. For the same number of hens, a summer ration might contain 1 pound of cracked corn, 1 pound each of barley and oats, 2 pounds of wheat, and 1 pound of beef scraps. Both of these rations are for hens confined in yards; if they run at large, the beef scraps and green food can be omitted from the ration during the summer season when grass and bugs are plentiful.

Any ration that contains 1 part protein to 4½ parts carbohydrates and fat combined, is an egg-producing ration, provided that a fair proportion, almost one-half—$\frac{13}{29}$—of the nutrients contained in the food is digestible. Five ounces per day is a full allowance of food material for the average laying hen. This allowance should in each case consist of a little less than 10 per cent. digestible protein and about four and one-half times as much carbohydrates and fats. The proportion of dry matter may be increased and the digestible nutrients decreased and the same nutritive ratio be maintained; but by this change a percentage of the feeding value is lost in waste, and for lack of digestible food material such a ration fails of its purpose. For successful results, the relative proportions must be maintained and, if changed, no loss can be allowed in the digestible nutrients.

12. Yearly Consumption of Food.—The average amount of food eaten yearly by well-fed yarded hens is given in Table VI. The figures given in this table were derived from careful records of the food eaten by several hundred hens during an entire year.

TABLE VI

AMOUNT OF FOOD REQUIRED BY ONE HEN IN A YEAR

Food	Amount Pounds
Grain of all kinds and meal	90.0
Oyster shell and bone	6.4
Grit	2.0
Charcoal	2.4
Green food and clover hay	10.0
Total	110.8

This table shows a total average of about 4.86 ounces, or a little less than 4 ounces of grain and meal, and about $\frac{9}{10}$ ounce of other material per day for each hen. Another test of forty-eight hundred hens shows a food consumption of 3.96 ounces of grain per day, besides green food and grit. Hens that pick their green food from the range do not lay more eggs in winter than do those that are fed liberal amounts of green food of a quality equal to that on the range. The same quantities of food are eaten when a portion of the ration is fed in hoppers from which the hens help themselves as when single meals are given at once. The water consumed by the fowls is not included in the table.

TABLE VII

WEIGHT OF POULTRY FOODS PER QUART

Food	Weight Pounds
Alfalfa meal	1.0
Barley, whole	1.5
Barley meal	1.1
Beans	1.9
Beef	1.5
Buckwheat	1.3
Corn, whole	1.7
Corn meal	1.5
Corn bran	.9
Corn and oat food	.7
Cottonseed meal	1.5
Gluten feed	1.3
Gluten meal	1.7
Hemp seed	1.4
Hominy chop	1.1
Kaffir corn	1.7
Linseed meal, new process	.9
Linseed meal, old process	1.1
Millet	1.6
Oats, whole	1.0
Oats, ground	.7
Peas	1.9
Rice	1.7
Rye, whole	1.7
Rye, ground	1.5
Sunflower seed	1.4
Salt	2.5
Shorts	.6
Wheat, whole	1.9
Wheat, ground	1.7
Wheat bran	.5
Wheat middlings (standard)	.8
Wheat middlings (flour)	1.2

13. Measuring of Grain.—It is often more convenient to measure grains with the ordinary dry measure than to weigh them. Table VII shows the approximate weight per quart (dry measure) of the common poultry foods.

THREE-GRAIN RATIONS

14. As has been stated, the value of rations is largely dependent on the quantities of protein and carbohydrates present, without special inquiry as to what particular food material is their source. It is well, however, to gather them from the grains and feeds that are most abundant. Wheat, oats, and corn are staples in all localities, and are the most nutritious of grains. These grains and their by-products are the best and cheapest foods for poultry, and they can be combined into a variety of rations that will supply many needs of the poultry. In Tables VIII to XIII, inclusive, six rations that, with a single exception in which barley is substituted for wheat, are made from these three grains, their by-products, and a little meat and green food. To have a properly balanced egg-producing ration, 10 per cent. of meat scrap may be fed. Table VIII shows the proper proportion of the different foods in a whole-grain and meat-scrap egg-producing ration.

TABLE VIII

WHOLE THREE-GRAIN RATION

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbohydrates Pounds	Nutritive Ratio
Wheat	10	9.00	.180	1.020	7.300	1 to 7.2
Oats	5	4.45	.150	.460	2.840	1 to 6.2
Corn	5	4.45	.075	.395	3.820	1 to 9.7
Meat scraps	2	1.78	.082	1.324	.622	1 to 0.5
Total...	22	19.68	.487	3.199	14.582	1 to 4.6

15. Table IX shows a meal or ground-grain ration with barley meal in place of the wheat in Table VIII. This ration may be fed as a wet or as a dry mash, as preferred.

The materials used in the grain and meat rations shown in Tables VIII and IX can be used in compounding several other rations; for example, 10 pounds of cracked wheat, 4 pounds of oatmeal, 5 pounds of siftings from cracked corn, and 2 pounds of granulated meat scraps form a good ration for young growing chicks. This ration does not contain a large percentage of ash and, when used, grit and other mineral matter must be added to it. The meal and meat ration contains more dry matter and ash, but lime in some form should be fed in addition to the meals. Grit, shell, charcoal, and green food should be given to fowls with all rations.

TABLE IX

MEAL AND MEAT RATION

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbo-hydrates Pounds	Nutritive Ratio
Barley meal......	10	8.90	.240	.870	6.920	1 to 7.9
Corn meal........	5	4.45	.075	.395	3.820	1 to 9.7
Ground oats......	5	4.45	.150	.460	2.840	1 to 6.2
Gluten meal......	5	4.60	.040	1.290	3.280	1 to 2.5
Meat scraps......	1	.89	.041	.662	.311	1 to 0.5
Total..........	26	23.29	.546	3.677	17.171	1 to 4.7

16. Dry-Meal Rations.—Mixtures of dry meals can be made from the by-products of grains; four common rations made from these products are shown in Tables X to XIII, three of which are fit for laying hens; the fourth is a fat-forming ration.

17. As has been stated, rations in general may be described as *narrow*, *balanced*, or *heavy*, as the case may be, these terms all being useful.

TABLE X

NARROW RATION

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbohydrates Pounds	Nutritive Ratio
Wheat bran	10	8.80	.580	1.220	4.530	1 to 3.7
Ground oats	10	8.90	.300	.920	5.680	1 to 6.2
Wheat middlings	5	4.40	.190	.640	3.035	1 to 4.7
Alfalfa	5	4.60	.370	.550	2.115	1 to 3.8
Meat scraps	2	1.78	.082	1.324	.622	1 to 0.5
Total	32	28.48	1.522	4.654	15.982	1 to 3.5

TABLE XI

BALANCED RATION FOR GROWING CHICKS

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbohydrates Pounds	Nutritive Ratio
Wheat bran	10	8.80	.580	1.220	4.530	1 to 3.7
Ground oats	10	8.90	.300	.920	5.680	1 to 6.2
Wheat middlings	10	8.80	.380	1.280	6.070	1 to 4.7
Alfalfa	5	4.60	.370	.550	2.115	1 to 3.8
Meat scraps	1	.89	.041	.662	.311	1 to 0.5
Total	36	31.99	1.671	4.632	18.706	1 to 4.0

TABLE XII

HEAVY RATION

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbohydrates Pounds	Nutritive Ratio
Wheat bran	10	8.8	.58	1.22	4.530	1 to 3.7
Ground oats	10	8.9	.30	.92	5.680	1 to 6.2
Wheat middlings	10	8.8	.38	1.28	6.070	1 to 4.7
Corn meal	10	8.9	.15	.79	7.640	1 to 9.7
Alfalfa	5	4.6	.37	.55	2.115	1 to 3.8
Total	45	40.0	1.78	4.76	26.035	1 to 5.5

TABLE XIII

WIDE RATION

Food	Quantity Pounds	Dry Matter Pounds	Ash Pounds	Protein Pounds	Carbohydrates Pounds	Nutritive Ratio
Wheat bran	10	8.8	.58	1.22	4.53	1 to 3.7
Ground oats	10	8.9	.30	.92	5.68	1 to 6.2
Wheat middlings	10	8.8	.38	1.28	6.07	1 to 4.7
Corn meal	20	17.8	.30	1.58	15.28	1 to 9.7
Total	50	44.3	1.56	5.00	31.56	1 to 6.3

18. Narrow Ration.—A **close,** or **narrow, ration** contains proportionately less carbohydrates and more protein than does the balanced ration. When a close, or narrow, ration is fed, a portion of the protein is lost or wasted through use in place of some of the carbohydrates or fats that are not present in the ration. The narrow ration in Table X has a fair proportion of dry matter and ash, and an excess of protein. By taking part of the meat scraps from this ration, it may be changed to a balanced ration. A narrow ration can be safely fed to young chicks or to laying hens that are kept closely confined in yards; it is also the proper ration for young ducklings. This same ration is not good for fowls that have partial or free range of the field.

19. Ration for Laying Hens.—A balanced **ration for laying hens** contains 1 part of protein to a little less than 5 parts of carbohydrates and fats combined. The whole-grain ration, Table VIII, and the meal and meat ration, Table IX, are both well balanced; the balanced ration in Table XI is close to the line between the narrow and the balanced ration. This is a dry-meal ration and a good mixture for winter use as a dry mash. The balanced rations in Table VIII and in Table IX may be fed for winter egg production and can be safely used in all localities.

20. Heavy Ration.—Sufficient ash and protein for egg production are contained in the heavy ration given in Table XII. It is called a **heavy ration** because it contains more fat-forming material than is needed for egg production. This is an excellent ration for a mixed flock of fowls having the freedom of the range; the ration not only furnishes suitable material for eggs but it also provides the right kind of food for the production of good market poultry.

21. Wide Ration.—A ration that has a nutritive ratio of 1 to 6.3 or more is known as a **wide, or fattening, ration,** the large proportion of fat and starch making it a fat-forming ration. The wide ration is fed for producing table meat, and has very little value as a food for growing chicks or for producing eggs. The wide, or fat-forming, ration given in Table XIII can be fed as a dry or a wet mash for fattening fowls of all kinds. While rich in fats and carbohydrates, it does not overheat the fowl even when liberally fed; the addition of fat-meat scraps to this ration makes it more efficient and also more expensive. Rations can be made from all kinds of grain or meal used for poultry; they should be compounded so as to serve the purpose for which they are to be fed. The nutritive ratio of any ration can be determined by the values and guide rations given in the tables.

TIME AND MANNER OF FEEDING

22. Time.—When fowls are free to roam, they begin their search for food at dawn and continue a restless search until the close of day forces them to rest. This same manner of feeding should be followed as closely as possible in artificial systems of feeding. Fowls confined in yards are compelled to live in an unnatural way and are necessarily fed at the convenience of those who care for them. To maintain health in the flock, their morning meal should be fed at dawn, and the daily ration is usually divided into three or more meals. A flock of laying hens that can range freely should be fed not less than twice a day; if confined part of the time, they should be fed three times a day; and if entirely dependent on the food that is given to them, it is best to divide their food into four or five feedings.

The early morning meal can be planned for the hens the night before, and the grain can either be scattered into the litter or thrown on the ground or floor where the hens will find it as soon as they leave the roost; the other meals should be given at regular intervals. Hens are creatures of habit, and if irregularly fed they are restless and discontented. If overfed, they become fat and lazy; but if their food is insufficient, they neither prosper in health nor produce eggs. The digestive apparatus of a hen, as has been shown, is easily thrown out of adjustment; supplied with good food it acts with precision, but if it is neglected it stops and fails to accomplish its regular duties. Regularity in time of feeding and in the quantity of food given is of great importance. The knowledge of the time and manner of feeding and of when a hen is fully satisfied must be acquired.

23. **Mechanical Feeding.**—Mechanical devices of many kinds are used for feeding. Among them are automatic feeders, from which the fowls may at any time help themselves as do cage birds. These devices are described in *Poultry Houses*, Part 3. Hopper, or automatic, feeding is useful for partial feeding at all times and it is a safe method of feeding growing chicks and poultry that is to be fitted for the market. Hopper feeding should not be entirely relied on for the feeding of laying hens, but may be useful in giving them their early morning meal. Certain types of automatic feeders are so made that they serve the dual purpose of exercise and feeding; the efforts made by the hens to dislodge the grain from the feeder affording continual exercise, which is beneficial to hens that are kept in yards or are otherwise confined. The ordinary hopper feeders are preferable, especially if they are supplemented with grain cast in the litter for the hens to scratch after; good exercise is thus furnished.

The box or hopper system is especially well fitted for the use of laying hens that are confined in yards. Dry mixtures of ground grains or other prepared foods, or dry mashes as they are called, are frequently used under these conditions. Hoppers that will hold several days' supply of the mixture are filled with it and placed so that the fowls may help themselves at any time. It is best, however, when introducing this system, never to put more than one day's supply of dry mash in the hoppers at once. The hoppers may be attended to at night at the same time that the morning ration of whole grain is scattered for the fowls. A mixture of dry meals made of equal parts by weight of wheat bran, wheat middlings, and alfalfa meal, with 7 per cent. of meat scraps, is used as a dry mash. Hoppers that will hold several days' rations are filled with this mash and the hens help themselves continually from it.

When this system of feeding is being introduced into a poultry plant, only as much dry mash as is desirable for one day's use should be put into the box each evening after the fowls have gone to roost; this mash, together with a portion of grain, is left for their early morning meal. After a few days the hens will eat sparingly of the dry mash, provided the proper amount of grain is fed to them at regular intervals. The dry mash is a *supplementary* food supply that is more quickly digested than the whole grain. When the hens are accustomed to this manner of feeding, the hoppers can be filled and kept constantly supplied with the dry mash. If a fair proportion of grain and other foods is given, the hens will not eat too much mash, but if the birds are underfed they may gorge themselves from the hopper. Grit, shell, and charcoal should also be fed from a hopper. Hens accustomed to this system of feeding will not overeat, but if there is an excess of fat-forming material in the hoppers, they are apt to select this kind of food and fatten on it. Ordinarily, the foods fed in hoppers should be rich in egg-forming material. Neither whole corn, cracked corn, nor corn meal, nor any other grains or meal rich in starch or sugar should be fed in hoppers to laying hens.

24. Feeding Place.—As the ground that is long used for the purpose of feeding becomes tainted and contaminated with disease germs the **feeding place** should be frequently changed. Grain for hens confined in yards should be well scattered or raked into the soil. During the winter season the grain for hens should be so placed that they must scratch to get it. Scattered chaff, straw, hay, or other broken fodder about the barn form excellent feeding places for farm hens. If the fowls are confined in yards or houses, the food should be thrown into the litter on the floor inside the hen house, or into the litter in the scratching shed or outbuildings. Food for fowls must not be thrown into wet or dirty litter nor on wet or moldy ground. The feeding of chickens, turkeys, ducks, and geese on the same ground ought to be avoided; each kind of bird should have a separate feeding place.

25. Exercise.—Without **exercise,** which is of as much importance as good food, the fowls are continually ailing and do not produce eggs. By compelling the fowls to dig and hunt for food they are given exercise that removes inactivity and increases the body heat. Exercise expands the lungs and develops heart action to such an extent that the health improves, the appetite increases, the digestion is made better, and as a result of all these activities more eggs are produced. It is possible, however, for the hens to have too much exercise. If the litter is deep and heavy it imposes an excess of work on the hen to enable her to gain a food supply. Healthful exercise rather than laborious work is the requirement necessary to improve the health and increase the egg yield of the hens. Exercise requires the use of the fat-forming principles in foods and prevents the fowls from becoming fat. Fowls that are continually hunting for small grains do not acquire bad habits, while if they obtain their food with little effort they will not exercise enough to warm their bodies and are liable to acquire many bad habits.

26. Natural Exercise.—Fowls obtain the most natural exercise in wandering over fields in search of bugs and seeds, or in scratching in the leaves or grass of the woods or fence corners in search for food that is hidden beneath. Poultry runs that are overgrown with trees and strewn with leaves are natural open-air scratching shelters where grain can be fed to the fowls during all kinds of weather, provided that the ground and leaves are dry. The value of wooded lots or runs that are overgrown with underbrush cannot be overestimated. No place is better for the laying hen or the growing chick than partly cleared land, overgrown with scrub oak or pine trees, provided the danger from birds of prey and vermin is not too great. In places like this, fowls, both young and old, obtain natural exercise and food, and vitality is secured and maintained.

FOOD

DESIRABLE FOOD

27. Importance of Variety in the Diet.—The appetite is sharpened and the digestion improved by a **variety** of grain and other foods. The system revolts against the continual use of one unpalatable food; in this way Nature asserts herself and demands a varied diet. Every locality furnishes many kinds of foods suitable for poultry, and from these foods it is nearly always possible to select a wholesome diet; consequently, it is seldom necessary to send far for poultry food. In one section, a mixture of corn, wheat, meat scraps, and coconut-oil-cake meal is favored; but in another section where Kaffir corn is abundant, this grain, together with a very little cottonseed meal, flaxseed, and ground alfalfa, can be fed. These rations can be balanced to meet the demands for egg production, growth, or market meat.

28. Wholesome Foods.—Any kind of food that promotes health, vigor, and egg production is fit for poultry, provided it is free from disagreeable odors that can be transmitted to the flesh or to the eggs. No one kind of food is vastly superior to all others. While corn, wheat, oats, barley, and their by-products are highly favored in many districts, their use is not imperative. In China, whole rice in the hull is fed, and the ration is balanced with fish, bugs, and worms. In the wheat-growing belts, wheat and its by-products are used; where oats are grown in abundance, they are the staple foods for fowls. In connection with these local products, other foods must be used to balance the carbohydrates and fat, and to furnish the nitrogen necessary for growth and egg production. If part of the food supply must be purchased, it is well, if possible, to buy concentrated foods that are rich in nitrogen. Relatively much nutrition can be obtained from these foods, and a small portion will balance a ration that has an excess of fat and carbohydrates.

TABLE XIV
30-DAY RATIONS FOR SIXTEEN HENS

Food	Quantity Pounds	Food	Quantity Pounds
(*a*)		(*b*)	
Corn	50	Corn	50
Oats or barley	24	Oats or barley	24
Wheat bran	10	Wheat bran	10
Middlings	5	Flour middlings	4
Corn meal	25	Corn meal	28
Beef scraps	8	Animal meal	7
Cut clover	10	Cut clover	10
(*c*)		(*d*)	
Corn	50	Corn	50
Wheat	25	Wheat	25
Corn meal	28	Corn meal	25
Flour middlings	2	Wheat bran	10
Hominy chop	10	Middlings	5
Beef scraps	7	Alfalfa meal	4
Cut clover	10	Beef scraps	7
(*e*)		(*f*)	
Alfalfa hay or meal	18	Alfalfa	18
Wheat bran	10	Wheat bran	14
Middlings	30	Middlings	17
Coconut-oil-cake meal	10	Linseed-oil-cake meal	6
Meat meal	6	Blood meal	4
Wheat	60	Barley or oats	25
		Wheat	50
(*g*)		(*h*)	
Corn meal	24	Wheat shorts	18
Wheat bran	18	Corn meal	25
Alfalfa meal	10	Blood meal	5
Blood meal	3	Alfalfa meal	5
Meat meal	6	Cottage cheese	12
Oats or barley	30	Wheat	60
Wheat	40		
(*i*)		(*j*)	
Wheat bran	40	Wheat	60
Middlings	20	Cracked corn	30
Corn meal	20	Oats	15
Alfalfa meal	40	Barley	15
(*k*)		(*l*)	
Corn meal	10	Middlings	30
Molasses feed	20	Wheat bran	24
Middlings	40	Meat meal	6
Wheat bran	30	Skim-milk	90
Meat scraps	10	Wheat	60
Clover hay	10		

29. Concentrated Foods.—Some **concentrated foods** should be used to a very limited extent only. Among these foods is cottonseed meal, the use of which should never be long continued. It should never be fed oftener than three times a week, and on these occasions not more than 2 per cent. of the ration should consist of this meal. Rupture of the egg-producing organs and death follow the continuous and liberal feeding of this product. Gluten meal of good quality is a better poultry food than cottonseed meal; it is a reliable and palatable food, and no ill effects follow its use. Coconut-oil-cake meal is safely used; linseed-oil-cake meal, not to exceed 10 per cent. of the ration, may also be fed.

30. Quantity.—Some of the most desirable rations are shown in Table XIV. The quantities given in each division are sufficient for feeding sixteen hens for 30 days, and provide about 4 ounces of food daily for each hen. The whole grain in all these rations should be fed by hand; the meal and meat in each should be mixed together and be fed either as a wet or a dry mash. Rations (*i*) and (*j*) are double, or two-part, rations. One-half of the daily ration should be fed from each; the two will answer for 60 days. Rations (*a*), (*b*), (*c*), and (*d*) are best suited to a promiscuous lot of fowls ranging in age from 6 months to several years. Rations (*e*), (*f*), (*g*), and (*h*), being largely composed of concentrated foods, will be best suited for laying hens. Rations (*i*) and (*j*) are for laying hens that have free range and are able to pick up insects enough to supply their demand for animal food. Rations (*i*) and (*k*) are fed in hoppers as dry mash. The molasses feed used should be of good quality. Ration (*l*) consists of meals, wheat, and milk; the meals should be moistened with the milk. The milk not used in this way is made into cottage cheese and is fed in this form. In the use of all rations where meals only are mentioned, a daily ration for each hen should consist of 2 ounces of dry meal, fed wet or dry, and an equal amount of whole grain.

31. Grit and Shell.—None of the foregoing rations furnishes enough mineral matter for egg formation and for the other demands of nature. Each hen requires each year for the formation of eggshells as much lime as is contained in 2 pounds of oyster **shells.** Cut green bone, crushed dry bone, and animal meal should also be used to furnish other mineral matter. **Grit,** as has been seen, is essential for the proper digestion of food and must be supplied to the fowls. Hard limestone grit is especially valuable, as it not only helps to grind the other food but is itself partly assimilated and helps to form eggshells and bones. It should be remembered that shell and bone cannot take the place of grit.

32. Ground Food.—The most nutrition can be extracted from food the assimilation of which is not hastened by unnatural influences. Regular and uninterrupted work of the digestive organs has a healthful influence over the entire system, and if the digestive organs are disturbed, the entire organism is unbalanced. **Ground food** and by-products from the manufacture of human foods are more readily digested by poultry than whole grains, for less labor is imposed on the digestive organs in grinding the meal into pulp than is necessary with hard grain. Like whole grains, meal and by-products should be of the proper composition. Ground foods should not be extremely concentrated, nor is it best to have them of a fattening nature. Only a part of the daily ration should consist of ground food.

33. Mash Feed.—Wet mash is more quickly digested than is ground food given as a dry mash. For this reason, the wet mash is preferred when it is desirable to have a speedy assimilation of the food. This kind of assimilation is sometimes desirable, for it is possible by using mash food to produce more eggs in a given length of time than by the use of whole grains, but generally the use of wet mash is to be avoided. Wet mash is laxative; it passes quickly through the crop and gizzard, and it imposes an unnatural labor on the liver and intestines; the more moisture the mash contains, the greater the strain imposed upon these digestive organs. There is more waste in feeding wet mash than in feeding dry feed; less of the food value is secured from speedy digestion and more of the food is wasted in the excrement. If the mash is to be fed wet it should be mixed into a crumbly mass with the use of as little moisture as possible. It should be so mixed that when cast on the ground it will break into bits; if moistened with warm milk, the mash is less laxative than if moistened with water. All wet mash should be moistened with hot fluids.

34. Cooked Foods.—Thorough boiling improves the value of some foods for poultry. One-half of all the food fed to growing fowls can be thoroughly **cooked** and good results obtained from its use. When the entire ration is cooked and fed damp, bad results will follow. Refuse from the kitchen, if cut into small pieces in the bone mill, mixed with vegetables and meal, and thoroughly cooked, makes excellent food for fowls. Small or broken beans, peas, potatoes, and other vegetables, when mixed with ground food, boiled and fed warm, make an excellent egg-producing ration. The labor and expense of cooking are the chief objections to the use of much cooked food. All wet mash is best if thoroughly cooked.

35. Green Food.—Fowls can exist without green or vegetable food of any kind, but they do better in every way if a portion of their daily ration is **green food,** vegetable food, or a substitute for it. They may have as much of this kind of food as they will eat. Hens in confined quarters, if given a liberal supply of green food, produce more eggs than they do without it. At least one-tenth of the food fed to fowls should be green.

36. Hay.—A supply of clover or alfalfa **hay** should be kept where the fowls may at any time help themselves from it. A frame made of slats and fastened at the bottom with hinges against the side wall forms a manger from which the hens can pick the leaves from the hay; for a large number of fowls, mangers are made of slats and placed so that the hens can get at them from all sides. The leaves of clover and alfalfa hay are especially relished by the fowls, and they will consume small particles of hay of all kinds. Hay made from clovers contains ash that is valuable for poultry, and the food constituents of clover hay seem to be unusually well suited to hens. Steamed clover aids in egg production. Clover hay strengthens and invigorates the digestive system by distending the intestines and aids in digesting concentrated foods. No trouble results from the judicious feeding of clover hay, but if the fowls eat too many large pieces their crops will become distended and clogged.

UNDESIRABLE FOOD

37. Foods of Poor Quality.—Light-weight grains encased in hulls are unwholesome poultry food; and on account of their excess of crude fiber they are little better than straw. So few of the mixed foods that are made for cattle are fit for poultry that it is wise to avoid them all. Foods exceedingly rich in protein are to be avoided if they have also a large portion of dry material. The dry matter in foods may be partly digestible or wholly indigestible. Those foods in which the dry matter is wholly indigestible should never be used as food for fowls of any kind. Barley, oats, or wheat of poor quality are to be shunned, because the energy expended in digesting them is out of proportion to the nutrition obtained from them. Poor meal that contains a surplus of crude fiber is unfit for food. It is wasteful to feed poor bran, shorts, or middlings to poultry.

Highly concentrated foods can be used with safety, provided they do not contain injurious elements. Cottonseed meal is not of vital importance as food for poultry, and it is best to omit it from the ration because of dangers incident to its use. Foods composed of unknown ingredients should be eliminated from foods for poultry. Fowls do not like rye, nor is it a valuable food for them; there is so little good and so much risk in its use that it should not be used. Foods that excite the heart's action and disturb the egg-producing organs are dangerous; they induce internal troubles and may cause death.

38. Poisonous Foods.—Fowls sometimes die from ptomaine poisoning. Putrid meat, spoiled grain, and other fermented or spoiled foods are frequently the source of this poison. Foods that are otherwise wholesome are made unwholesome through dampness or mold. Dead animals or vermin in meal or grain may render the food unfit for use. Contact with poisonous drugs or other dangerous products may poison grains or meal so exposed. Fatal poisons are found in putrid water, and whole flocks of fowls are sometimes killed by eating for grit rock salt that has been poured on the ground from an ice-cream freezer. Mixtures of sulphate of iron and sulphuric acid, or blue vitriol carelessly used, poisonous mixtures used as sprays and left exposed, all result in death if eaten by the fowls.

Salt meat or the brine from which the meat has been removed, salt fish, and the brine from fish barrels or ice-cream freezers are fatal to poultry of all kinds, if freely eaten or drank by them. Decayed vegetables or fruits, the fermenting waste from cider mills or canning factories, grains and slops from distilleries, are all detrimental to egg production, and when hens are fed on them the flavor of the egg is influenced; they also taint the meat of the fowl that feeds freely of them. Any or all kinds of fermenting foods are detrimental to fowls. Grain or grain by-products that are damp, heated, and moldy, are improper poultry foods, because they disturb digestion and cause bowel trouble even though they may not poison the fowls that eat them. Any food that disturbs the digestion or causes bowel trouble is not fit to be fed to fowls of any kind.

Nothing is more injurious to poultry food than mold. It often appears in stale bread and meals of all kinds; it may exist inside the shell of an egg and contaminate the chick prior to its coming from the shell. Grain may have a wet or musty odor and still be wholesome food for fowls; the danger lies in the rapid growth of the green mold that follows such conditions. Bread may be freed from mold by toasting or baking it perfectly brown, dry, and hard; it can then be reduced to small particles for feeding. Grains of all kinds can be cleansed of mold by passing them through a fanning mill and by sprinkling them with lime wash and drying them. To make the wash, mix 1 quart of slaked lime with 9 quarts of hot water. To clean the grain, pile it and moisten it with this mixture; stir the pile with a rake until all the grain is coated, then spread the grain on cotton cloth and dry it in the sun. When the grain is thoroughly dry, remove the excess of lime by shaking the grain in a basket or bucket before feeding it to the fowls.

SPECIAL-PURPOSE FEEDING

SYSTEMS AND VARIETY IN FEEDING

39. Systems of Feeding.—Poultry may be successfully fed by the use of a **system** in which dry food alone is used, or by one in which part of the food is given as a wet mash or gruel. A system of some kind must be followed, because regularity is of prime importance in caring for poultry. Sudden changes in the system of feeding are liable to produce disastrous results.

40. Dry Feeding.—The system of **dry feeding** is more closely in accordance with natural feeding than are the other methods. The use of all dry food is beneficial to health; its use lessens the danger of bowel troubles and other ills of the digestive tract, and permits the liver to continue its functions undisturbed. An excess of labor is forced on this organ by the use of unnatural food. Grains in their natural state, meal made from them, by-products, meat scraps, and other wholesome foods, all may be fed in the dry state.

41. Wet-Mash Feeding.—Feeding systems other than dry are grouped under the term **wet-mash feeding.** This system is the more generally used. By its employment the labor of the crop and gizzard are lessened but additional labor is thrown on the liver and other organs and, while the food is more speedily assimilated, there is a waste of food material.

42. Importance of Variety in the Ration.—As has been seen, one kind of food used constantly will not answer unless it is a balanced ration within itself, and even then the system of the fowl will revolt against the prolonged use of a single food. Corn, the acknowledged peer of any grain as a poultry food, will destroy life if fed alone constantly; hulled oats, which is a near approach to a balanced ration, cannot be long endured as a single-grain ration. If a mixture of many kinds of foods is fed to poultry, the individual will select from it a diet that is best suited to the needs of its body at the time the food is consumed. The fat-forming foods are generally chosen first; and if there is enough of these foods to satisfy the appetite, too much fattening food will be eaten. To avoid this, only the needed amount of the fat-forming grain should be put into the diet. The other foods should be rich in protein. Fowls of all kinds, both old and young, naturally select a surplus of fattening foods, and in this way store up fat against a time of want.

43. Change of Diet.—If a change of diet is desirable, it should be made gradually; for example, if linseed meal is to be substituted for middlings, a small amount of the middlings should be removed from the ration each day, and the linseed meal should be added gradually. A sudden change of diet may disarrange the entire digestive system and cause indigestion and bowel trouble. Ailments that are mistaken for cholera come suddenly after radical changes of diet, and frequently a sudden change in meals given as mash food causes the trouble. There is less danger in a change of grain food. There is a wide scope for the selection of grain food for hens; many rations of widely different kinds of food can be used and excellent results obtained from each. This seems to prove that it matters less what is fed than would at first appear. The important factor is that the digestible food principles be present in the proper proportion and amount and that the ration be palatable.

FEEDING OF YOUNG CHICKS

THE FIRST FEW WEEKS

44. While the use of nutritious foods and the practice of regularity in feeding them are essential for success in all branches of poultry feeding, nowhere are these things more necessary than in the feeding of newly hatched chicks. The yolk, which is absorbed by the chick just before it comes from the shell, supplies all the food needed during the first 48 hours of the chick's life. Grit to aid in the digestion of food is what the young chick needs first. Small grains of sharp sand and small pieces of eggshell are admirable for this purpose, and the chick should not be allowed to eat anything else until the morning of the third day. Stale bread moistened with sweet milk and then pressed nearly dry is an excellent first meal for the young chicks, as is also whole warm milk direct from the cow. For the next 2 or 3 days, stale bread crumbs and fine oatmeal may be fed at 2-hour intervals. Only small amounts of food should be given at each meal, there is more danger of the chicks suffering from overfeeding than from underfeeding.

Phosphate of lime, and other mineral matter is quite as essential to the chicks as are other forms of food. Small particles of sand and eggshell will supply this need until the chick is at least 2 weeks old; after that age, small grit and bone meal should be supplied constantly. After the first week, the method of feeding must be governed largely by the season of the year and the purpose for which the chicks are intended. If the chicks are hatched in midwinter, a method of feeding different from that used during the spring and summer season must be practiced. If the chicks are intended for broilers, they should be fed for early market; if grown for general use, they must be fed for steady and regular growth to a vigorous maturity.

45. The first 4 weeks form the most critical period of the chick's life, and after this period has passed the danger of loss from natural causes grows less with each succeeding week. The hardest struggle for existence begins after the first few days and continues until the chicks are about 4 weeks old. There are numerous more or less successful methods of feeding the young, growing chick. The secret of success, however, is to feed the chicks enough good food to have them thoroughly satisfied after each meal and yet hungry for more when the next feeding time comes. Suitable amounts of wholesome foods must be fed. A pleasing variety, neither too few nor too many foods, must be supplied. The ration for young chicks must be rich in protein and unless they can run about in the fields where there are plenty of insects and worms, some kind of animal food must be added to the rations, for grains and cereals will not supply all the food principles needed. To sum up, the most satisfactory growth will be secured by feeding rations with a nutritive ratio of less than 1 to 4.

TABLE XV

FEEDING STANDARDS FOR YOUNG CHICKS

Age of Chick	Amounts per 100 Pounds of Live Weight of Chicks					Fuel Value Calories	Nutritive Ratio
	Dry Matter Pounds	Protein Pounds	Fat Pounds	Carbohydrates Pounds	Ash Pounds		
First 2 weeks	10.1	2.0	.4	7.2	.5	18,800	1 to 4.1
Two to 4 weeks	9.6	2.2	.5	6.2	.7	17,730	1 to 3.4
Four to 6 weeks	8.6	2.0	.4	5.6	.6	15,640	1 to 3.3
Six to 8 weeks	7.4	1.6	.4	4.9	.5	13,780	1 to 3.7
Eight to 10 weeks	6.4	1.2	.3	4.4	.5	11,680	1 to 4.3
Ten to 12 weeks	5.4	1.0	.3	3.7	.4	10,000	1 to 4.4

46. Table XV shows the amounts of digestible nutrients required daily per 100 pounds of live weight of chicks of different ages from 2 to 12 weeks. As the chick matures, the nutritive ratio widens but does not reach the wide ratio of the fattening ration. A closer, or narrower, ratio is required in the food of the chicks that are grown in confined quarters than is needed for those that have the natural advantages of a free range.

47. There is no method of feeding growing chicks that positively assures success. Vitality of constitution in the chicks themselves is absolutely essential, and if this quality is lacking no system or method of feeding can be successful. If, however, the chicks are strong, numerous methods of feeding can be used with marked success, care being taken to see that the right foods are used to build up and maintain the body. If the chicks fail to thrive, it is an indication that the proper elements are not present in their ration, or that individual vitality is lacking. If many of the young chicks thrive and a few do not, this indicates a lack of vitality in a few; if the entire lot fails to flourish, it is evidence either that vitality is lacking or that the ration is absolutely wrong. When this latter thing occurs, the ration should at once be changed to one of all cooked food.

48. Simple Ration.—For chicks that are a week or more old, a **simple ration** can be made of 4 parts, by weight, of cracked corn, 2 parts of broken wheat, 2 parts of oatmeal, and 2 parts of granulated scraps. The corn should be broken into small pieces and the meat scraps must be of good quality, rich in protein, and of small size; beef scraps that contain fat are not fit to use in this ration. After the chicks are 6 weeks old, a ration made of cracked corn, whole wheat, and hulled oats with beef scraps can be used. In addition to the grain and meat ration, grit, green food, broken sea shell, or bone meal are necessary for young chicks. All food fed to chicks should be in small particles to avoid disorders in the crop and digestive organs.

49. Cooked Food.—Stale bread, dried hard in the oven and broken into particles small enough for the chicks to eat, makes excellent food, provided it is not brown or burned; cracker crumbs can also be used with equal success. Stale bread moistened with sweet milk, rice boiled in water and drained perfectly dry, and equal parts of rice, broken beans, and peas boiled into a pulp and mixed with equal parts of corn meal and fine oatmeal into a dry, crumbly mass, are excellent foods for chicks that fail to grow. Corn bread made of 5 pints of corn meal, 1 pint of wheat middlings, ½ pint of small particles sifted from beef scraps, and 6 eggs, all mixed with skim-milk, sour milk, or buttermilk to the proper consistency and baked in the oven, forms a superior food for chicks of all ages. A little baking soda should be put into the milk used to moisten the meal, and clear or infertile eggs tested from the hen or incubator can be used in making this corn bread. When dry, provided it is sweet and free from mold, this bread can be passed through a bone cutter and broken into small pieces.

50. Egg Food.—Infertile or clear eggs that have been tested from incubators or hens can be used as food for chicks. A food that can be used in the ration of chicks of any age can be made by boiling such eggs for 30 minutes or longer and then passing them, shells and all, through a bone cutter. The finely cut eggs are then mixed with five or six times their weight of dry bread or rolled oats and the mixture is finally passed through the cutter. This food is best adapted to chicks between 1 and 6 weeks of age; too much of it will be injurious—as much as the chicks will eat quickly twice a day is enough. The **egg food** should be placed on flat pans, clean boards, or in shallow feed dishes or troughs, and these utensils must be removed as soon as the chicks have finished eating. Small portions of this food can be mixed with a fork, spoon, or wooden paddle.

51. Moist Mixtures.—Damp or moistened mash can be fed to chicks twice a day with satisfactory results. The mash can be made from 4 quarts of corn meal, 3 quarts of ground oats or barley free from hulls, 2 quarts of wheat bran, 2 quarts of white middlings, and 2 quarts of fine beef scraps, all mixed and moistened into a crumbly mass with hot or cold water, or with sweet or sour milk. The milk should be scalded, not boiled. This mash can be used in place of the egg food;

and it can be fed to the chicks twice a day, after they are 3 weeks old. As soon as the chicks have eaten their fill of this, the feed troughs containing it should be removed.

TABLE XVI

MIXTURES FOR CHICK FOOD

Food	Quantity Quarts	Food	Quantity Quarts
(*a*)		(*b*)	
Shelled corn	16	Millet seed	.5
Wheat	8	Cracked Kaffir corn	1
Hulled oats	4	Cracked wheat	2
Pearl barley	3	Canary seed	1
Millet seed	.5	Oatmeal	1
		Finely granulated meat	.5
(*c*)		(*d*)	
Fine siftings from cracked corn	40	Fine broken corn	35
Cracked wheat	30	Cracked Kaffir corn	6
Oatmeal	10	Cracked wheat	40
Millet seed	3	Hulled oats	30
Granulated meat	7	Broken peas	5
		Animal charcoal	5
		Millet seed	5
		Beef scraps	10
(*e*)		(*f*)	
Cracked corn	50	Cracked corn	200
Whole wheat	50	Whole wheat	300
Clipped oats	30	Barley	200
Barley	10	Clipped oats	100
		Screenings	200
		Buckwheat	100

Neither the egg food nor the mash should be left to sour after the chicks have satisfied their hunger. When the egg food or mash is fed, the chicks should have three meals of grain and two of either one of these latter foods per day.

52. Chick Food.—The name **chick food** is used to describe mixtures made from food materials that are used for feeding chicks. Many kinds are manufactured and sold commercially; if they are of good quality, their use may be convenient and safe. Chick food can be made of numerous kinds of grains and seeds. Any of the mixtures given in Table XVI form suitable chick foods. After the grains in (*a*) have been ground and mixed, 4 quarts of beef scraps should be added to the mixture; (*a*) is adapted to chicks having the free range of the farm; (*b*) is for Bantams or chicks of tender constitution; (*c*) and (*d*) are for those partly or wholly confined; (*e*) and (*f*) are grain mixtures suitable for half-grown chicks on the range.

53. Time of Feeding.—Young or growing chicks should have their first meal of the day as early as it is light enough for them to see to eat. This early morning meal should be composed of dry grain and it can be left at night where the chicks will find it at daybreak. Small iron dish hoppers can be used for this purpose and there should be only as much food given to the chicks as they will eat. The second meal should be given 2 hours later, and may be composed of egg food, mash feed, or chick food; if the meal is made up of the last-named food, it should be scattered in dry chaff. Two hours after this second meal, another lot of egg food or mash is placed in the dish and left only long enough for the chicks to satisfy their hunger, after which the hoppers are taken away and cleaned. Two hours before sundown, an ample supply of grain is fed to them by throwing it into the chaff on the floor. The chicks thrive better if fed five times a day until they are 6 weeks old, after which age they may be fed four times daily; and at 8 weeks of age, three meals a day are sufficient. The following schedule may be observed in feeding five meals a day:

First Meal.—Soon after daylight. Bread crumbs, seed, or small grain, according to age.

Second Meal.—Eight or nine o'clock. Egg food, mash feed, or chick feed, according to age.

Third Meal.—Noon. Small grains or chick feed, scattered into chaff or dry litter of some kind.

Fourth Meal.—Two o'clock. Either egg food, mash feed, bread softened with milk, or johnny cake.

Fifth Meal.—Four o'clock. A full meal of small grain or chick feed, scattered in the chaff or litter.

The small grains and chick feed should be scattered in dry chaff or cut straw. Fine or short-cut alfalfa or clover hay makes good litter; sand, sawdust, or chips of wood are undesirable litter for chicks. Clean, dry earth may also be safely used for litter.

54. **Supplementary Food.**—Corn bread, bread and milk, milk curds, or cottage cheese are **supplementary foods** that can be used to make welcome changes in the diet of young chicks. These materials can be fed at any time in place of the second or the fourth meal; they are rich, concentrated foods, and must always be cautiously fed. Warm bread and milk with a dash of red pepper as a tonic can also be fed occasionally when the days are very cold. Chicks that are fed regularly with wholesome, nutritious foods, and neither overfed nor underfed should thrive.

55. **Drink.**—An ample supply of water should be kept where the chicks can help themselves from it at will. This supply should be so placed that they will neither stumble over it nor fall into it. If water is not constantly within reach, the chicks become very thirsty, and when the supply is renewed they are apt to gorge themselves, thus causing diarrhea and death. Water fountains with shallow dishes are admirable for holding the water supply; pans, dishes, or saucers, through which the chicks can run are not suitable for holding it. Fresh milk, sweet skim-milk, and even sour milk can be given as drink to young chicks, but the liquid should be kept in a vessel from which the chicks can drink, but from which they *cannot scatter the milk about.*

LATER FEEDING

56. Feeding of Growing Chicks.—The young of the domestic hen, also that of other fowls and birds are usually called **chicks** until the sexes can be distinguished. **Chicken** is a name also applied to the young of the domestic hen, and the same name is used for referring to market chickens of all ages. The term **growing chicks** refers to the partly grown chicks, usually on the range. After the chicks are 12 weeks old, they may be classed as growing chicks and they should be fed for a useful maturity, either for egg production or for market poultry.

57. Ration for Growing Chicks.—The same ration can be used to grow chicks for any purpose. There are several methods of feeding them that will fully satisfy their needs. For a few chicks that are grown in partial confinement, one method can be practiced, while for a large number grown under like conditions, another method must be used; and although the manner of feeding growing chicks on the range differs from both of the methods used in feeding confined chicks, all must be fed a ration adapted to their needs. Chicks that are confined on a limited range must of necessity have all their needs supplied, while those that have free range will pick up a large portion of their food.

An excellent grain ration for a few chicks growing in confinement may be made from equal parts of cracked corn, wheat, oats, and barley. With this grain ration the chicks should have each day either a wet or a dry mash made up, by weight, as follows: Gluten meal, 5 parts; wheat bran, 5 parts; linseed-oil-cake meal, 1 part; beef scraps, 5 parts. If this mash is fed dry, 5 parts of alfalfa meal should be added. Chicks that are not free to range must have plenty of green forage. For a large number of chicks that are kept in confined quarters, the same ration can be used. Perhaps the most difficult task in poultry growing is to keep a large number of fowls on a limited area and have them flourish after they reach the age of 3 months. This branch of poultry growing, as well as that of feeding the cockerels after they are separated from the pullets, will be treated in *Market Poultry*. The chick-food mixtures (*e*) and (*f*) given in Table XVI can be used for chicks that have a free range where there are many insects, bugs, and worms.

FEEDING OF LAYING HENS AND PULLETS

58. Hens and pullets do best when they are kept in separate flocks and are fed in different ways. Pullets demand more fattening food than hens and they do not store the surplus fat as the hens do. The ration fed to hens should contain less starch than that for pullets. Notwithstanding the fact that hens require less fat-forming food, they prefer that kind and will select it from the ration to the exclusion of other more wholesome foods. When hens and pullets are kept and fed together, the hens are apt to get more fat-forming food than they need and the pullets may suffer from lack of it. For this reason, the best results will not be obtained by keeping the young and old stock in the same flock. Hens that are a year or more old should be fed a narrower ration than is needed for pullets. Pullets that are well grown by fall will produce more eggs during their first year of laying than they will as hens the following year. Because of this fact, pullets require more food than old hens do.

Perfectly sound, dry grain is best for laying hens. The weight of grain is often an indication of its quality. Good shelled corn or wheat should weigh not less than 60 pounds per bushel. Oats that weigh less than 30 pounds per bushel are unfit for food for laying hens. Light-weight, immature, or shriveled grains, or grains with an excess of husks, often lack the valuable elements needed for egg production. It is good economy properly to feed the best of grains to laying hens.

59. Necessities for Egg Production.—A grain ration that will grow chicks to a perfect maturity contains the same principles that are required for egg production, but, as has been shown, there is a larger per cent. of ash and less protein in an egg than in the body of the hen. Grains of all kinds contain sufficient fat for egg formation, but fat alone does not meet the demands for egg production. There must be material to meet the other requirements for egg production. The yolk of the egg is 16 per cent. protein, 30 per cent. fat, and 53 per cent. water. The white of the egg is 12 per cent. protein, 2 per cent. fat, and 84 per cent. water. Both white and yolk contain a trace of mineral matter. The eggshell and membranes of the egg are largely lime, and there is about 120 grains of mineral lime in the shell of each egg. The average grain does not contain enough ash for the proper formation of eggs, so the lime necessary for the eggshell must be secured from oyster shells or other substances that are composed largely of lime and that can be readily reduced to a semiliquid pulp within the gizzard. Bones are largely lime, those of cattle being more than one-half lime. Granulated bone or bone meal as a source of lime for hens is fully equal to oyster shell. Dry mortar made of lime and sand, or small bits of lime can be picked up by the hens and used for the formation of eggshell.

All grains contain more or less mineral matter and an excess of fat in proportion to protein. The lack of mineral matter can be readily supplied from cheap material, but the protein must be taken from concentrated foods that contain a high per cent. of digestible matter that is rich in protein. Animal food is the material from which protein is most readily assimilated by the fowls, and beef scraps is one of the best animal foods. Good beef scraps that contain 66 per cent. protein costs about $50 per ton; that having 35 per cent. protein is worth $25 per ton. Milk also is a source of protein, but milk that contains 4 per cent. of protein is worth for poultry food only $4 per ton. To secure the requisite amount of protein, several times as much milk as beef scraps must be fed, provided that 1 ounce of the casein of milk is equal in food value to ½ ounce of beef scraps. Milk products are palatable and easily digested; meat is more liked by the hens, but not so readily digested. Gluten meal is rich in protein and is quite digestible; gluten feed is often used in place of gluten meal, but it is neither so rich in protein nor so nutritious and digestible.

60. Protein From Meat.—No other food equals **meat** as a concentrated food from which protein for eggs can be obtained. Although more eggs will be produced in winter by hens that are fed meat in their ration than from any other system of feeding, it is quite possible for the eggs that are laid during the cold weather to cost more in food and labor than can be obtained for them. Cheap foods must be selected whenever it can be done without danger of lessening too much the yield of eggs. Then again, economy can be practiced through careful feeding and by not feeding more concentrated food of any kind than is needed.

As has been said, 1 pound of meat scraps or cut green bone is sufficient for the daily ration of thirty hens; 1 pound of meat scraps to 10 pounds of meal can be used as a mash for laying hens; ½ ounce of cut green bone can be safely fed to laying hens each day. If these products are mainly mineral matter and fat, they will not assist materially in egg production, but if they are largely protein, they will be of value for increasing the yield of eggs. Meat that is lacking in egg-producing qualities is wasted if fed to laying hens; for fat fed to hens produces body heat and fat. It is the protein value of meat that influences the yield of eggs. Soup that is excellent for moistening mash can be made from any kind of meat. The carcasses of horses and cows that may have outlived their usefulness may be used for this purpose. The resulting boiled meat may be used to balance a corn ration. Large quantities of boiled meat may be eaten by the fowls with no evil consequences, while beef scraps, cut green bone, and raw meat of any kind have a tendency to cause indigestion and bowel troubles.

61. Protein From Milk and Vegetables.—Protein for eggs has been successfully obtained from casein, cottage cheese, and other milk products; in some localities these materials can be fed at less cost than meat of any kind. Protein from beans, peas, and other legumes, and vegetables is more easily digested than that from animal food but is not quite equal to it for the formation of eggs. Linseed-oil-cake meal is one of the best, if not the best, substitute for meat. Any or all of these materials can be fed as a substitute for meat, and where the cost is less than that of meat they will generally prove to be a profitable substitute. Beans and peas that are cooked and fed with meals as a mash are far better for the hens than if fed raw. Bean and pea meal can be used in the mash, and in some sections peanut-oil-cake meal is fed successfully.

62. **Grain Mixtures for Laying Hens.**—If the cost of grains and cereals differs, it is well, for reasons of economy, to select those least expensive in the place where they are fed. Many combinations that meet the requirements for egg production can be made. Any one of the fattening mixtures can be used as hereafter suggested, or other rations may be made, the grains used depending on the cost.

63. **Two-Part Rations.**—Table XVII shows ten two-part rations; those in the left-hand column are wide, or fattening, rations; those in the right-hand column are narrow, or egg-producing, rations. In using these rations, the flock is fed from a wide ration and the narrow ration opposite. Ration (*a*) is a wide, or fattening, ration best suited to a very cold climate, and with it is fed the narrow ration (*b*) as a mash; neither ration by itself is adapted for egg production. Rations (*c*) and (*d*) are used together as a whole-grain and meal ration, as are also (*e*) and (*f*). All these mixtures are suitable for winter feeding, and if fed together they form a satisfactory ration for laying hens. The wheat middlings should contain sufficient gluten to make them white. Good buckwheat middlings will answer quite as well as the wheat middlings.

Rations (*g*) and (*h*) are narrow rations best suited for hens that are closely confined during the winter months. These rations contain considerable crude fiber and a plentiful amount of digestible matter. When fed together, these two

TABLE XVII

TWO-PART RATIONS

Food	Quantity Pounds	Food	Quantity Pounds
(*a*)		(*b*)	
Cracked corn	100	Wheat bran	50
Whole wheat	100	White middlings	50
Clipped oats	25	Corn meal	25
Barley	25	Meat scraps	25
Buckwheat	25	Pea meal	25
(*c*)		(*d*)	
Whole corn	50	Corn meal	25
Wheat	50	Wheat bran	25
Barley	50	Gluten meal	25
Oats	50	Linseed meal	15
(*e*)		(*f*)	
Whole corn	50	Corn meal	25
Barley	10	White middlings	5
Oats	10	Alfalfa meal	3
		Meat scraps	5
(*g*)		(*h*)	
Cracked corn	40	Wheat bran	20
Wheat	20	Corn meal	10
Oats	20	Gluten meal	10
Barley	10	Linseed meal	10
Buckwheat	10	Beef scraps	10
(*i*)		(*j*)	
Corn	60	Ground oats	50
Wheat	30	Wheat middlings	50
Kaffir corn	60	Casein	20

rations are excellent for egg production. Rations (*i*) and (*j*) are suitable for a corn-growing district where Kaffir corn is plentiful and casein is obtainable at a reasonable price; these two rations must also be fed together, the one as a whole-grain ration and the other as a mash. They are adapted to hens that must rough it more or less during the winter. Meat scraps can be used as a substitute for the casein.

64. In using the two-part rations, three meals per day are given unless the mash is fed in hoppers, in which case the hens help themselves from the hopper at will, and the whole-grain part of the ration may be fed in the morning and afternoon. One quart of grain is enough for the morning meal of twenty-five hens. The grain should be well scattered throughout the litter. Unless a hopper system of feeding is practiced, the mash may be fed at any time between 10 and 12 A. M. Two quarts of the mash mixture moistened with hot water or scalded milk is enough for twenty-five hens. Between 3 and 4 o'clock the third meal, consisting of 1 quart of grain, should be given. Fed thus, each twenty-five hens will receive 4 quarts of food per day, or about 4 ounces per hen daily. When the meal mixture is used as a dry mash, 20 per cent. of alfalfa meal should be thoroughly mixed with it and the whole mass put into an automatic feeding hopper from which the hens may help themselves during the entire day.

65. Cut Clover.—If of good quality, free from stems, and cut into short pieces, clover or alfalfa hay is a valuable addition to the wet mash; 25 per cent. of the mash may be made of these hays. To mix this mash, the short-cut hay is covered with boiling water and steamed for 10 minutes; the surplus water is then poured off and the meal mixed with the clover. In order to secure the proper crumbly consistency, it may be necessary to add to the mass some of the water drained from the hay. The entire mixture should be fed to the hens while it is warm. Alfalfa meal may be used in place of cut clover. There is less waste in the use of this meal for dry mash than in that of finely cut hay.

WINTER FEEDING

66. Material to supply energy, heat, and motive power must be furnished to the hens during the entire winter season. In winter hens will not move about to keep themselves warm; they roam in search of food but not for exercise. If kept confined, they must be compelled to exercise; and if at liberty, must be encouraged to run about. If left to their own inclination, the hens will fill their crops with corn and stand about until time to go to roost. Winter poultry foods, therefore, must include the necessities for existence and be so fed that the fowl is constantly encouraged to search for food. If the hunger of the fowls is never fully satisfied during the day, they will hunt constantly for food; and for this reason, the one full meal of grain should be given at night. The habit of testing the efficiency of the ration by feeling the crop of the hen after she is on the roost is a good one; if the crop is full, the hen is well fed; if it is partly full, she is not sufficiently fed; and if it is empty, she is slowly starving to death. If the hen is well fed and in good condition, but does not produce eggs, either the ration is at fault or the hen is a poor egg producer.

The hen is most active during the period of regular egg production. The laying hen cannot be a drone; she must gather food elements to maintain her activity and to produce eggs. When on the range during the early spring, she selects her food from the tender green plants that come into life at that time, and from bugs and worms. Her search for these induces new life, which is evidenced by brightness of eye, richness of color in face and comb, and an elastic movement of the body that tells of increased activity. A healthy condition is induced by a system of feeding that encourages activity during the winter months. If she is given fattening foods in abundance, the hen becomes lazy; if any of the necessary food elements are lacking, all the food eaten is utilized to produce heat and fat, and egg production fails because the ration is not balanced. All the needs of the body must be fully satisfied before eggs are formed.

67. Egg Production.—Egg production in the northern hemisphere declines rapidly in August and continues to diminish until the molt ends. Pullets that begin to lay early in the fall will lay less as winter approaches; both hens and pullets fail naturally in their yield of eggs at that time. Egg production in the northern hemisphere increases naturally during January and continues until the maximum is reached, usually in April, or sooner in some localities. Usually a full yield is maintained until the end of May, after which time it gradually declines until the minimum production is reached. No method of feeding has fully overcome these natural conditions, but great improvement has come as a result of care and system, and more will follow as better use is made of the knowledge that comes from experience. The fertility of the eggs also declines as the number of the eggs decreases.

68. Food Consumption.—Obviously more solid food and water are required during the period of maximum egg production than when fewer eggs are being produced. Hens that are laying well are seldom fat, but their weight increases rapidly as the egg yield decreases, except during the molting period. Pullets that are in the flush of egg production consume more food than do hens; 3-year-old hens increase in weight more rapidly and lay fewer eggs and consume less food than do pullets or yearling hens. All hens need more food during very cold weather than they do when the weather is moderate. The needs of the hens must govern the system of feeding, and the amount of food given to them should be increased or diminished according to the weather conditions. Although the amount of food given should always satisfy their demands for food, the fowls ought never to be overfed. Fowls that are overfed do not relish their food and the grain best suited for egg production is neglected. When this neglect occurs, the proportion of the neglected food in the rations should be increased. As long as there is considerable grain left uneaten in the litter, no more should be fed. Fowls should clean up all the grain fed to them each day, and if this is not done the amount of grain should be reduced and the grit and green food supply increased. If the grain in the litter becomes moldy, the house should be thoroughly cleaned and the litter renewed with fresh, clean material. Fowls that neglect their food and refuse to partake of grain should be separated from the flock and be compelled to live on water alone for a day or two, after which a little bread can be fed until the desire for food returns.

69. **Modern Methods.**—The feeding of bran, middlings, meals, and other by-products as dry mash to fowls is a modern custom that overcomes the necessity for feeding wet mash continually. Meal is more quickly digested than whole grain; if meal is fed in hoppers and is kept constantly before the fowls, they eat a little at a time and are satisfied with this small amount, provided they have a grain ration fed to them regularly; but if the hopper is empty and only the partial ration of grain is fed, they are underfed and may suffer for lack of food. If the hoppers are constantly full and the grain ration neglected, they will overfeed from the hoppers and the entire system becomes deranged because of a surfeit of concentrated food. To secure the full advantage from this modern method of feeding, each detail of the plan must be carried out; even reasonably fair results cannot be obtained if any part of the system is omitted.

70. **Stimulants.**—There are a few drugs and spices that can be used cautiously as tonics for poultry. Foods of this kind stimulate the heart and other organs to speedy action, but **stimulants** must be sparingly used or undesirable results will follow. *Capsicum*, or *red pepper*, is considered the best tonic for poultry; *red carbonate of iron* may also be safely used. *Black antimony*, *fenugreek seed*, and other like condiments should be avoided; foods that stimulate the egg-producing organs to unnatural action are dangerous. A mixture of equal parts of capsicum, ground cloves, allspice, and ginger is an excellent tonic to feed in the mash to stimulate action during cold and wet weather. Satisfactory results in some cases are obtained from feeding a tablespoonful of this stimulant twice a week during cold or wet weather to each

twenty-five fowls. A tablespoonful of red carbonate of iron can be used as a tonic for an equal number of fowls in molt. This amount may be fed in the mash every other day while the molt continues. Iron fed to white fowls while in molt darkens the color of the new plumage. Fowls in good health and condition do not need a tonic of any kind.

71. Salt.—The use of **salt** in poultry food is not a necessity; but when birds are fed a forcing ration either to produce broilers, to fatten fowls, or to produce eggs, some salt may, however, be used to assist digestion. Eight ounces of salt to 100 pounds of meal is enough to use; much more than this will poison the grown fowls, and it is positively unsafe to feed more to the young chicks.

72. Water.—As a part of the daily ration, **water** is equal in importance to grain. Without water, the food would not be softened in the crop and digestion would not go on. Blood, eggs, and meat are all largely water; even the bones and muscles are dependent on moisture for growth. Pure water is an absolute necessity for poultry; if the drinking water is tainted, putrid, or contaminated with germs, disease is sure to follow its use. If the fowls kept in confinement do not have an abundance of pure water, their digestive organs become diseased. The indications of this are dark face and comb, dull or dead-looking plumage, lack of activity, and no egg production. A gallon of fresh water each day is not too much for two dozen hens; therefore, a plentiful supply of pure water from which they can help themselves must be constantly kept within reach of the fowls.

73. Flavor and Color of Eggs.—The flavor of the eggs and the meat of fowls is influenced largely by the food they consume; ill-flavored foods destroy delicate flavors. Food selected for fowls should be free from any taste or odor that will be objectionable in table meat or eggs. Just as milk is made bitter by rank weeds eaten by cows, so eggs may be contaminated by barnyard odors or unsavory foods; fowls that dig their living from barnyards and pig pens may send the odors of such surroundings to the table in their flesh and eggs. The food and water supply of fowls will influence the color of their flesh and the yolk and albumen of their eggs. Fowls with yellow skin and flesh are improved in appearance for the table if they are fed on the meal of yellow corn; oats and barley meal mixed with milk lighten the color of the flesh. The yolk and albumen of eggs are darkened by the use of green food; hens that are deprived of green food lay eggs the yolk and albumen of which appear pale. Iron makes the yolk quite dark.

FEEDING OF FARM FLOCKS

74. Flocks of farm poultry are usually mixed lots that must be fed together. They must be so fed that a profitable yield of eggs and a plentiful supply of table meat is secured and the good health of the flock is maintained. If these things are not accomplished, financial loss is liable to result. No error in feeding farm flocks is more common or more disastrous than that of giving too much fat-forming food. An all-corn ration renders the hens excessively fat, sometimes induces apoplexy and causes the production of but few eggs. While corn fattens poultry, it does not produce the best table meat, for the flesh of fowls fed on corn alone lacks juiciness and flavor. On the whole, a ration that will produce a good yield of eggs is the best for the general farm flock.

Above all, a regular system of feeding the fowls and of caring for them must be practiced. A regular system for the farm fowls means a dry, comfortable shelter for the fowls and an abundance of good food at regular intervals. A grain ration for farm flocks may be composed of grains in the following proportions, by weight: Cracked corn, 20 parts; wheat, 40 parts; and oats, 15 parts. Cracked corn is preferable because it is small and, like wheat and oats, when cast into litter must be sought for by the fowls. During the winter all grain should be thrown into dry chaff or litter of some kind in order to keep the hens busy hunting for it;

this is equally desirable at all times for fowls that are kept in yards.

75. During the winter months, the hens on the farm should have a noonday feed of warm mash, the mixture being composed as follows:

Food	Pounds
Corn meal	40
Meat	30
Short-cut alfalfa or clover hay	30
Oyster shell	2
Grit	1
Charcoal	1

The meat may be either meat from farm animals, or waste from the butcher shop; and the alfalfa or clover may be finely cut or ground into meal. The other ingredients of the mixture insure a supply of grit and egg-shell-making material and aid in keeping the birds in good health. Cooked mash should be made like mush and may include table scraps, kitchen waste, small vegetables, their tops and peelings, and food of all kinds that otherwise may be wasted. These things should be cut into small pieces and boiled to a pulp, and before cooling this mass should be mixed with enough meal to make a dry and crumbly mass. When cool, this mixture can be fed to the fowls in a trough that is sufficiently long to accommodate all the hens at once.

76. For thirty fowls, 1 quart of grain mixture should be thrown into the litter early in the morning and as much of the mash as the entire flock will eat in 30 minutes should be fed at noon. Two quarts of the grain mixture to each thirty hens should be fed at night. No mash should be left in the trough after the hens are satisfied; if any remains, it should be gathered up and warmed over on another day. Experience and observation teach the quantity the fowls will eat; they should have all they will eat, but nothing to waste.

77. The grain ration given in Table VIII is good as a general-purpose ration for farm flocks, for it will furnish food elements necessary for the growth of young fowls and for the production of eggs without overfattening the hens. Only the finest quality of grain should be used in making it. Barley can be used either wholly or in part as a substitute for the oats. During the warm season, the amount of corn as given in the table may be considerably decreased. The meal ration given in Table X is rich in protein and is a necessary supplement to the whole-grain ration. If either the meat scraps or the alfalfa is omitted from the ration, its value as an egg producer will be practically nothing. The meat used must be lean and rich in protein; no pork or other fat meat should be used. Regularity in feeding this ration is as important as care in selecting the foods of which it is composed, and a close adherence to the system is as important as the selection of the foods.

78. Heating Foods.—Feeding hens for a yield of eggs during the winter season can be compared to the firing of a boiler. If too much heat-forming material is fed, the system of the bird becomes clogged with fat; if too little heating material is fed, the egg-producing material will be taken to supply the needed warmth for the body. If any necessary element is omitted, proper action will be wanting, and the motive power will fail to do its work. It should be remembered that eggs are formed after all the other needs of the organism have been fully satisfied; forcing for eggs means feeding in a way that satisfies all the wants of the fowls without imposing undue labor on any single organ. This end may be attained during the winter with farm flocks just as it is with yarded hens, provided a proper system of care and feeding is practiced. Cold will not prevent hens from laying, but during *very* cold weather they are apt to exhaust the supply of food to warm their bodies.

79. Waste Products.—Each kind of grain or vegetable —in fact, any foodstuff grown on the farm—can be used as food for poultry. The waste from the farm and kitchen can be used to feed the farm flock wholly or part. The dust and chaff from the thrasher contains many grains and weed seeds that are liked by the hens during the winter months; they will eat all the seeds if given the opportunity to hunt through waste product. When they have finished their search, the material that is left is better for the land than it would have been had it not been cleaned of weed seeds by the fowls. The waste from beans and peas, when they are thrashed, will be much relished by the hens in winter; small roots, broken grains, and screenings, all make good food for poultry. Tons of waste products like small potatoes, beets, carrots, turnips, and other vegetables too small for market can be cooked and made into palatable food for the hens and other farm animals. All waste material having any food value can be turned to profitable account by using a cutter and a cooker to prepare them for poultry or other farm stock. Any good method of feeding will bring better results from poultry having free range than can be obtained from fowls kept in confined quarters.

FEEDING DURING MOLT

80. Molting Period.—Fowls and other birds grow a new coat of feathers each fall. The time during which the old feathers are being cast off and the new ones grown is known as the **molting period,** which is a very trying time in the life of the fowl. The process of molting is Nature's way of keeping the bird in a sanitary condition. Its old, soiled, worn covering is replaced by a thick, new, clean one. Although the plumage of *chicks* really changes several times while the bird is coming to maturity, the change that takes place during the fall of the second year of the fowl's life is spoken of as the *first molt.* The body plumage of fowls is a little less than 5 per cent. of their entire weight, and there is one-fifth as much nitrogen in the plumage as is contained in the entire body formation. The body and two coats of feathers are grown during the first 9 months of the existence of the chick, and when it is realized that within 12 months of that time the hen must have sufficient nitrogen in the food she consumes to sustain her body, produce eggs, and grow a new coat of feathers, the presence of a good supply of this element in the food assumes renewed importance.

Fowls drop a few feathers at a time throughout the entire year, and, while hatching and rearing a brood, the greater part of the breast feathers of a hen disappears. A broody hen that sits for 3 weeks early in the season may molt twice in that year, and those that sit and rear a brood late in the summer usually molt, refeather, and begin to lay promptly. Fowls that begin to molt late in August or early in September do not usually complete their molt any sooner than do those that begin their molt in October. Hens that begin to molt in October generally complete the molt in about 10 weeks. The average period of molt is from 2 to 3 months. Laying hens seldom molt until they have nearly ceased laying, and while in molt they lay very few eggs. The molt of male birds usually continues longer than that of yearling hens, and hens more than 2 years old molt more slowly than do yearling hens.

81. Natural Molt.—During natural molt feathers drop gradually from the fowls; natural molt will not cause nakedness among the flock, and the fowls that molt in this way do not suffer from weather changes as do those that are partly stripped of their plumage and whose bodies are consequently exposed to wet and cold. Young hens molt more quickly than the older ones; excessively fat hens do not molt so well as do those that are in a more healthy condition. Those that are thin in flesh suffer from the strain and they cannot grow a new coat of feathers as they should. The hens that finish the molt early in the fall should lay well during the winter. Hens that begin to molt late in the season usually finish in less time than those that begin earlier. A natural molt north of the equator should be completed by the end of November and is likely to be followed by a large egg yield.

82. Food During Molt.—The bodies of fowls that are in molt must be specially nourished with the proper kinds of food to sustain the organs of development while they are under the unusual strain of replenishing the plumage. Foods rich in fat and protein are best for this purpose; the fact that fowls lose weight during molt proves that a steady drain on the system exists at the time. This strain is so great that it almost precludes the possibility of egg production during that period. Fowls in molt require heat-making elements in their food, also a plentiful supply of nitrogenous matter for growing feathers; consequently, the amounts of protein and fat in the rations fed at that time must be increased or the molt will not be satisfactorily completed. These additions can be secured most naturally from feeding more linseed-oil-cake meal and meat in the ration. Sunflower seeds also aid in the growth of feathers, but they contain so much indigestible fiber that they are much less desirable than linseed meal. During molt, mash that contains a large proportion of linseed-oil-cake meal and meat should be fed. The molting fowls should have a moderate meal in the morning, composed of equal parts of cracked corn and whole wheat, and at noon they should have all they will eat of warm mash made in the following proportions:

FOOD	QUANTITY QUARTS
Wheat bran	4
Wheat middlings	3
Ground oats	3
Corn meal	3
Beef scraps	4
Linseed-oil-cake meal	4
Flour	1
Alfalfa meal	2

During the first week of the molting period this mixture should contain only 1 quart each of beef scraps and linseed meal, which should be increased by 1 pint of each ingredient every other day until the amounts given in the table have been reached. If this ration proves to be more laxative than is desirable, the amount of meat and linseed meal is lessened and 1 pint of fine charcoal is added to the mixture. At night the fowls are fed all the corn meal and wheat they will eat. This way of feeding is continued until the molt is completed; then a laying ration is fed to the hens.

83. Forced Molt.—An attempt to force molt is occasionally successful, but the advantages derived from this practice do not usually offset the trouble caused. To force molt, fowls must be closely confined in the poultry house for at least 3 weeks. During this time they must be fed very sparingly, but should have all the fresh water they will drink. When the fowls are shut inside of the house the food supply must be lessened each day until at the end of the first week they will be fed only about one-third of the usual food supply. During the second and third weeks not more than 1 ounce of grain should be fed per day to each fowl. This partial starvation process will reduce flesh and fat and dry the oil from the quills of the feathers, causing them to drop more readily from the feather cells. The fowls must be liberated at the end of the third week and their food supply should be *gradually* increased. During the fourth week they should receive a full food supply; the food best for them is indicated in the preceding article. **Forced molt** may bring about a quicker shedding of the feathers, but, as a rule, the natural molt will prove the more satisfactory. Hens that have passed successfully through a forced molt begin to lay earlier than those that molt naturally, but they do not produce more eggs during the year.

NATURAL INCUBATION

THE EGG

FORMATION OF THE EGG

1. Nearly all forms of animal life come from eggs. In some instances, for example in man and in most domestic animals, the egg reaches its full development within the body of the mother, and the young are born living, breathing beings. In other cases the egg, protected by a shell, is deposited by the mother and must be exposed to heat for a greater or less time before the young life within it can emerge from the shell and exist by itself.

2. Development of the Egg Within the Hen.—The life of the hen's egg begins in the ovaries, which are attached to the under side of the backbone, usually on the left. The **ovaries** *a* in which the eggs are contained and the **oviduct** *c* through which they pass, are shown in Fig. 1. The yolk of the egg attains its full size within the casing of the ovaries, which, in good laying hens, contain yolks varying in size from that of a small pin head to that of the full-grown yolk. As soon as the yolk has reached its full development, the casing of the ovary, or **ovisac,** as it is sometimes called, opens and the yolk passes into the oviduct *c*. The yolk may or may not be fertilized by the male element before or just after entering the oviduct. The oviduct varies in length and in some cases it is nearly 2 feet long. As the yolk passes through the oviduct it becomes covered with albumen, of

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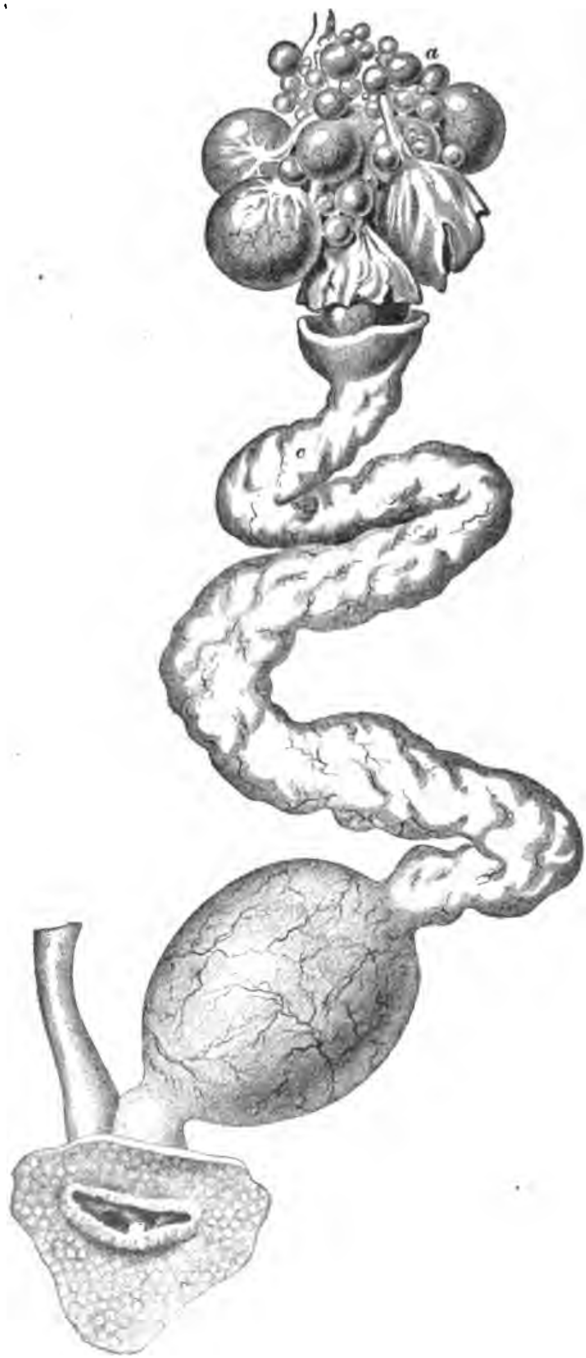


FIG. 1

which the white of the egg is composed, and with a double membrane, or the lining to the eggshell. After the egg has reached its full size the shell is formed about it. The passage of the egg through the oviduct requires from 6 to 18 or 20 hours.

3. **Structure.**—Fig. 2 shows in detail the **structure** of a hen's egg. As the egg passes through the oviduct, it is constantly being turned about, thus forming the **float,** or **chalaza** *c*, which supports the yolk and holds it in such a position that the **germ cell,** or **blastoderm** *d*, is always in an upright position. The blastoderm is the portion of the yolk from which the young chick develops. The blastoderm is tender and should never be allowed to come in contact with the shell lining *a*. It is for this reason that it is necessary to move frequently eggs that are being incubated. It is not advisable, however, to turn the eggs completely over, as is often done. The lining *a* is composed of two layers, which, at the large end of the egg, separate from each other and form the air chamber *b*.

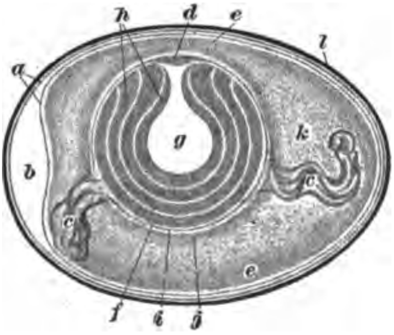


FIG. 2

Nature protects the germ by making the yolk slightly lighter in weight than the other portions of the egg. This fact causes the yolk to rise to the upper part of the egg, where it is kept from contact with the shell membrane by the denser coating of albumen *e* that lies next the shell. This heavier formation is a non-conductor of heat and protects the germ from cold during incubation. This albumen also acts as a bumper, and when the egg is moved the yolk rebounds as it comes in contact with this denser coating and is thus kept from coming into contact with the membrane of the shell. If the egg is allowed to rest on one side for any considerable length of time, the albumen becomes dry and fastens the germ to the membrane, thus destroying the life of the germ.

The yolk is contained within a very delicate membrane *f* known as the **vitelline membrane,** and it is composed of both white and yellow cells; if an egg is boiled hard and cut across, the flask-shaped center of white material *g* will be seen, around which are several concentric layers of yellow yolk *h*. With the microscope, additional thin layers of white yolk cells can be distinguished among the yellow layers. On the top of the white yolk rests the blastoderm *d*, a small disk about one-eighth of an inch across. The difference between a fertilized and an unfertilized egg is apparent only in this small disk, and much of its detail can be distinguished only by means of the microscope; but with a pocket lens it can be discerned that, while in an unfertilized egg the little disk is whitish all over except for small spots very irregularly distributed over its surface, in the fertilized egg an outer ring, or margin, is whitish with a smaller clear circle in the center in which are very small white spots. This central clear space is the germ from which the chick may be developed.

It should be clearly understood that when the blastoderm is in the stage indicated in the foregoing, a certain amount of development, or incubation, has already taken place since the germ was fertilized by the male element. This development is due to exposure to the heat of the hen's body while the yolk was traversing the oviduct. As the yolk entered the oviduct, the blastoderm consisted of a single cell, but during its passage, provided the egg had been fertilized, this single cell grew and multiplied until the blastoderm assumed its disk-like appearance. The blastoderm, when the egg is laid, usually consists of thin layers of cells. Although the extent of its development varies in different individuals, it ceases as soon as the egg is cooled. Perhaps the most wonderful thing about the hen's egg is its power to resume development after it has once stopped growing.

The vitelline membrane is protected with a layer of albumen *i*. This is encased and protected by heavier albumen *j*, into which the chalaza *c* is incorporated, and the whole compact formation floats in the more liquid albumen *k*, the white of the egg. The shell *l* is the most substantial portion of the egg, being very strong, yet porous. The germ cell *d*, the life-producing portion of the egg, has six distinct protecting layers between it and the outside of the shell. Corresponding protective layers are probably present in the eggs of other domestic poultry and of wild fowl.

A new-laid egg, broken and turned into a saucer, as shown in Fig. 3, has a full, plump yolk, which stands up in globular form, near the top of which is the round white spot *a*, the germ cell. The yolk floats in the heavier albumen *b*, which retains the shape of the egg. The chalaza *c* on either side of the yolk holds it in position. The yolk and the heavier albumen are finally transformed into a chick. The water contained in the egg is absorbed by the embryo or evaporated during the process of incubation. If a blood vessel of the casing, or ovisac, is severed when it opens to release the yolk into the oviduct, blood spots will appear on the yolk of a new-laid egg.

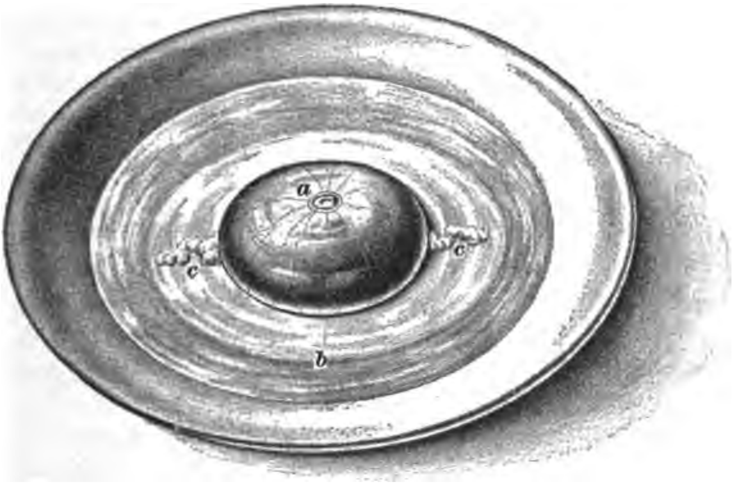


FIG. 8

4. Size and Shape of Eggs.—The eggs of the domestic fowl differ materially in **size** and **shape** from those of their wild ancestors. This greater variability of hen's eggs is due to their promiscuous breeding. Not only are the differences apparent when the eggs of different hens or of different birds are compared with one another, but the eggs of the same individual vary materially in form and size. The size, shape, and color of eggs may, however, be controlled by the careful selection of the eggs that are to be incubated. Round eggs with relatively large yolks and small whites are frequently caused by a deficiency of nitrogen in the ration. An excess of albumen and a deficiency of yolk are caused by feeding too much concentrated nitrogenous food. Abnormally large or double-yolked eggs come from excessive activity in the egg-producing organs. Every effort should be made to produce eggs uniform in size and shape. The eggs of the smaller breeds should average 2 ounces each in weight and those of the larger breeds should be heavier.

5. Color of the Shell.—The most usual **color of the shell** of eggs from fowls of Asiatic origin is brown, although this color ranges from a light chocolate to almost white. The shells of European fowls are normally white, but if these fowls are mixed with the Asiatics, the characteristic brown appears to some degree in the egg shells. The color of shell varies for the same fowl; the first eggs from pullets are richer in color than those laid near the close of the laying season. Fowls whose eggs are brown lay eggs of a darker color at the beginning of the laying season than at its close, while those whose eggs are white may lay eggs the shells of which are slightly tinted at the commencement of the laying season. Even the white eggs lose their rich bloom or finish as the end of the laying season approaches.

EGGS FOR HATCHING

6. The **size, shape, color,** and **finish** of the eggs of a flock of hens may all be improved by careful selection of the eggs to be incubated. The improvement may not be pronounced the first year, as large results cannot come from a single selection; to be successful the selection must be continued year after year. The eggs for incubation should come from one variety of hens that have health and vitality to a marked degree and the best results are obtained from such hens that are in their second or third year of laying.

The size of the offspring is influenced more by the female than by the male; small hens lay small eggs that produce small fowls, and larger eggs producing larger offspring may be expected from hens of greater size. In selecting eggs for hatching, eggs are chosen that are of true, regular shape and average size rather than those that are large or small for their kind. Special care is given to uniformity and clearness both in color and in finish of shell as well as to perfection of shape and smoothness of surface. The result of such care is invariably improvement in the quality of the chicks. Eggs that are over or under size, those that are imperfect in shape, rough of surface, or faulty in color of shell, should be discarded as not suitable for hatching. For the production of pullets that shall lay eggs with brown shells, select for incubation eggs that have that shade of color preferred. Pullets hatched from eggs whose shells are not uniform in color are apt to lay eggs with shells uneven in color. Those hatched from eggs whose shells are distinct and even in color will lay eggs of uniform color.

The appearance of white shells is materially improved by careful selection of the purest white-shelled eggs for incubation. Frequent examples of non-uniformity of the color of eggs are found in flocks of Leghorns, some members of which lay eggs with pure white shells, while other members of the same flock produce eggs that have a cream or straw tint. Either of these tints can be thoroughly established within a few years if eggs with only the desired tint are used for hatching. The production of pure white-shelled eggs is established in a flock by always selecting for hatching only the eggs with pure white shells.

The result obtained from mixing several breeds of fowls is a flock of hens that produce eggs the shells of which are uneven in color. The intermingling of white-shell producers and those that lay eggs with brown shells, results in having pullets that lay eggs of variable color and inferior quality. To have a product that is uniform and of even color, the eggs for hatching must be selected from hens of one kind mated to males of their own kind. The uniform color of the eggs produced by a flock of hens may be changed within two generations through the introduction of males of other breeds. Pullets from this cross may produce eggs of undesirable shade and finish.

7. Fertilization of the Egg.—In order that eggs shall hatch, the hen that lays them must have been mated with the male. The actual **fertilization of the egg** probably takes place as the yolk enters the oviduct. In the process of fertilization the germ from the male comes in contact with the blastoderm and causes it to develop, provided that it is exposed to the right temperature.

Even though an egg be fertile, it is not necessarily hatchable. To be capable of producing a chick, an egg must not only contain the living germ but there must be sufficient vitality to grow the chick to maturity. Lack of vitality often makes growth within the shell impossible, thus frequently causing the chicks to die in the shell. Eggs that are incapable of this growth are unhatchable. Hatchable eggs are those that are fertilized and have vitality enough to insure the production of a living chick.

Eggs are usually fertile up to and including those laid the ninth day after the hens are separated from the males, and fertilization is impossible after the sexes have been separated for 12 or more days. Eggs may safely be counted as fertile after the males have been with the hens for 9 days or more. Cockerels are more vigorous than are 2-year-old cock birds. If the fowls have their freedom, one cockerel to twenty hens or pullets is sufficient for the more active kinds; one cockerel to twelve or fifteen hens or pullets is quite enough for larger kinds. For yarded poultry not more than a dozen hens should be allowed for a cockerel. When fertility is lacking, male birds are changed daily from coop to pen; by so doing, two or three separate males can be used in the same flock.

The eggs of all kinds of fowls are more apt to be fertile during the spring and early summer than at any other time. Fertility begins to decline with the commencement of molting, and during the fall and winter the production of fertile eggs is at the minimum. The average production returns in January or soon after. Male birds are not very vigorous after the second year, but they can be used sparingly with a few hens the third year. Hens produce about three-fourths as many eggs the second year of laying as they do in the first, and after the third laying season they lay little or not at all. Second- or third-year eggs laid by hens mated with cockerels produce the most thrifty chickens. Hens over a year old mated to yearling cock birds are superior as producers to pullets mated with cockerels. Cockerels and pullets under a year old do not produce vigorous chicks.

8. Clear Eggs.—The eggs laid by hens kept separate from male birds are **clear, or infertile, eggs.** Some hens, even though mated, lay no other kind, and every mated hen lays an occasional clear egg. Clear eggs continue to be edible longer than fertile ones, and their food value is not lost even though they have been in an incubator or under a sitting hen for a week or longer. After such exposure their condition is the same as that of eggs in transit or in storehouses during the very hot weather; they are stale, but they do not spoil or decay as do fertile eggs similarly exposed.

9. Unhatchable Eggs.—Infertile eggs or those that contain weak germs are non-productive. Fresh-laid eggs may be fertile and contain an embyro that begins to grow and then dies. The new-laid egg may contain a diseased germ or one that was healthy at first but that became weakened by age or exposure to unnatural conditions. These eggs are all **unhatchable eggs.** Death occurs within the shell in all stages of incubation, from natural or unnatural causes, and because of the lack of knowledge and the inability to control the workings of nature this loss cannot be avoided. Unnatural environment is usually the cause of the lack of vitality from which result unhatchable eggs.

10. Period of Vitality in Eggs.—It is not safe to rely on the **vitality of eggs** 4 weeks old, yet eggs 3 months old have produced chicks that have grown to maturity. Eggs kept for hatching should be moved or turned about each day, and it is best to keep the small end of the egg pointing downwards. Cared for in this way, eggs can be safely kept 14 days. A uniform temperature of about 55° F. is best in which to keep eggs for hatching. If the eggs are turned about each day the yolk retains its natural position, but if left unturned for any length of time the yolk settles as shown in Fig. 4 and the egg will not hatch. The vitality of eggs that are exposed for any length of time to a temperature below 40° F. is impaired, and eggs thus exposed during cool or cold weather seldom hatch.

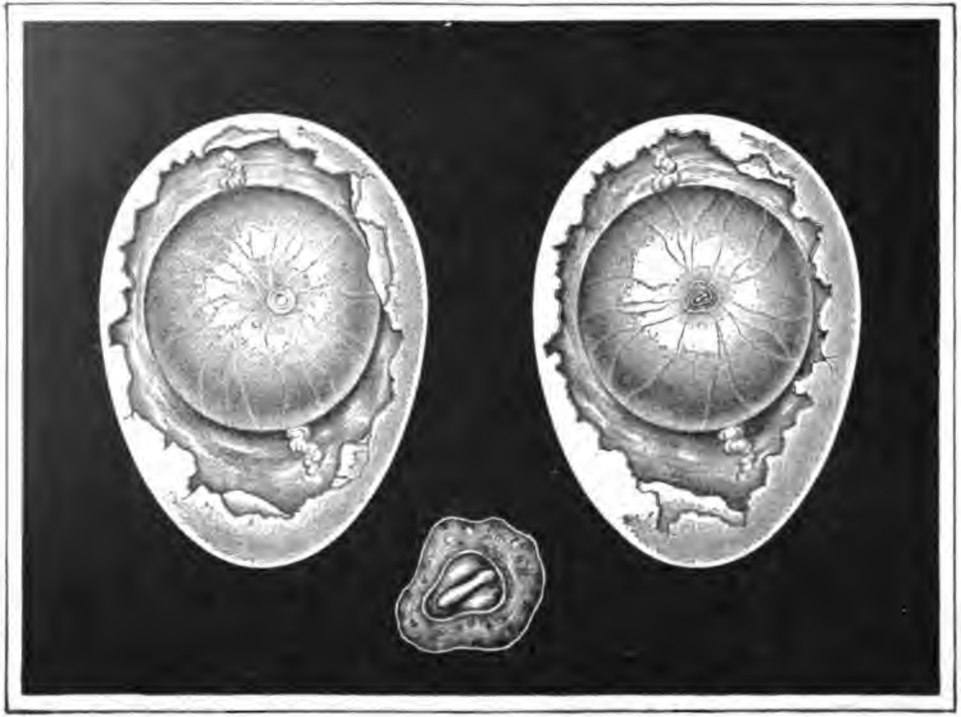
11. Control of Sex.—There is no way to control the sex of chicks, although many efforts to do so have been made. The size or shape of egg or air cell has no influence whatever on the sex; there are usually about equal numbers of male and female chicks hatched. Males, being the stronger, frequently predominate at maturity.. It is impossible to tell in advance which sex will be produced from an egg, nor can a fertile egg be selected by any method other than by testing after the fifth day of incubation.

DEVELOPMENT OF THE EMBRYO WITHIN THE EGG

12. **Temperature Necessary.**—When fertile eggs are exposed to a temperature of 100° F., or a little higher, the blastoderm begins to grow; if this degree of heat is long continued the formation of a definite embryo follows, from which, in the case of hen's eggs kept constantly in a uniform temperature of 103° F. for 21 days, living chicks result. The temperature under sitting hens varies from 95° F. to 105° F. The most satisfactory results are obtained from a temperature ranging from 102° F. to 103° F. The average temperature at the lower side where the egg rests in the nest is about 98° F.; at the center of the egg it is about 101° F., although at the surface or top of the egg the temperature registers about 103° F. Hens that fail to keep an even heat about the eggs as above indicated, fail to produce satisfactory hatches. If the temperature under the hen exceeds the normal or natural heat the eggs do not hatch properly. Hens exposed to unusual heat may fail to produce even a poor percentage of chicks from fertile eggs. The natural heat from brooding hens, however, usually produces the most satisfactory results.

FIG. 4

13. **Development of the Embryo.**—The **development of the embryo** really begins as soon as the germ cell has been fertilized and continues during the passage of the egg through the oviduct. The development is suspended at the time of the expulsion of the egg, provided it is not kept at the incubating temperature. The germ cell in the new-laid egg is a round body about which are two concentric circles, as shown in Fig. 5 (*a*). Leading from the fertilized germ cell and distributed throughout the egg are indistinct lines that indicate the future blood tracts. If the cell has not been fertilized, the egg remains clear, no matter how long it may



(a) (b) (c)

Fig. 5

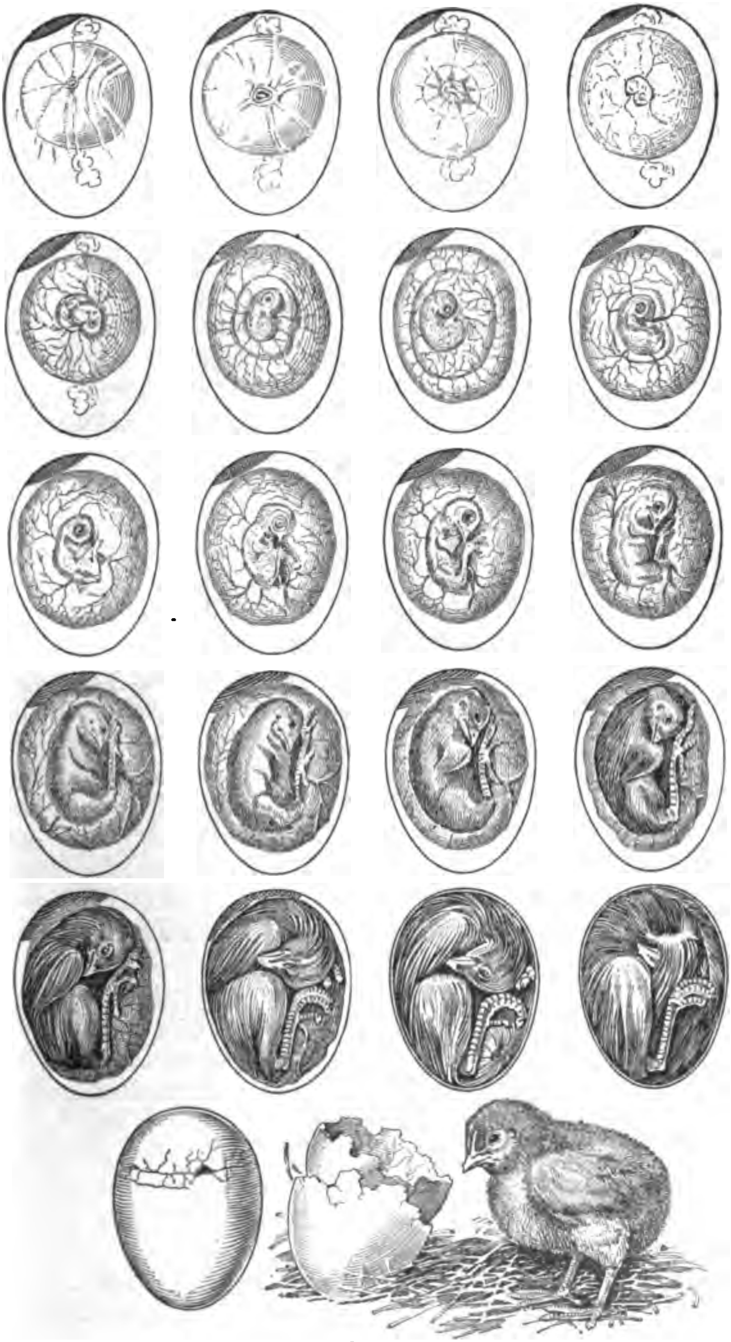


FIG. 6

be exposed to heat. If fertilized and the germ dies from any cause, the egg rots. This rotting occurs in time even though the egg may not be incubated. As soon as the fertilized eggs are thoroughly warmed in the process of incubation, development is resumed when there is a living germ. The development at the twelfth hour of incubation is shown in Fig. 5 (*c*). The germ cell is elongated and the center of the embryo has begun to take a more decided form, which is shown somewhat magnified in Fig. 5 (*b*).

The development of the embryo is shown by daily stages in Fig. 6. During the 48 hours following the beginning of incubation, the lines and head of the body become visible to the trained observer, blood also appears in lines along the surface of the yolk, traces of the backbone are to be seen, and indistinct lines show where the wings and large blood vessels are later to appear.

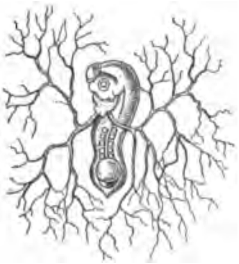


FIG. 7

During the third day the auricles of the embryo heart commence to work; the brain and eyes begin to develop; and the spine takes form prior to the uniting of these organs into a complete organization. The arteries and veins can also be seen at this stage; in short, an embryo, the shape of which may be clearly perceived, is now in existence. Viewed through a strong magnifying glass, the embryo with its fine blood lines is shown in Fig. 7.

The pupil of the eye is visible on the fourth day; the head is noticeably enlarged, the wings and thighs have taken form, and the outlines of the stomach, intestines, and liver become distinct. Before the close of the fourth day respiration is apparent.

During the fifth day the lungs take definite form and muscles appear. The heart is moved forward and the abdomen expands. On the sixth day the gall bladder becomes visible, and involuntary motion is noticeable. The liver is more plainly seen and the growth of the spine is extended. On the seventh day the skin and the feather cells begin to appear and the beak gradually takes definite shape. On the eighth day the brain, wings, thighs, and shanks have taken their natural form, though they still are little developed. The auricles of the heart are less rudimentary than at first, but are not yet fully defined.

The bones begin to take form and portions of them assume color on the ninth day; joints are visible as are the abdominal parts of the body. During the tenth day the muscles of the wings are completed and the feather cells considerably developed. On the eleventh day the arteries become distinct and attach themselves to the heart; bones are hardened and the embryo takes definite shape as a young chick.

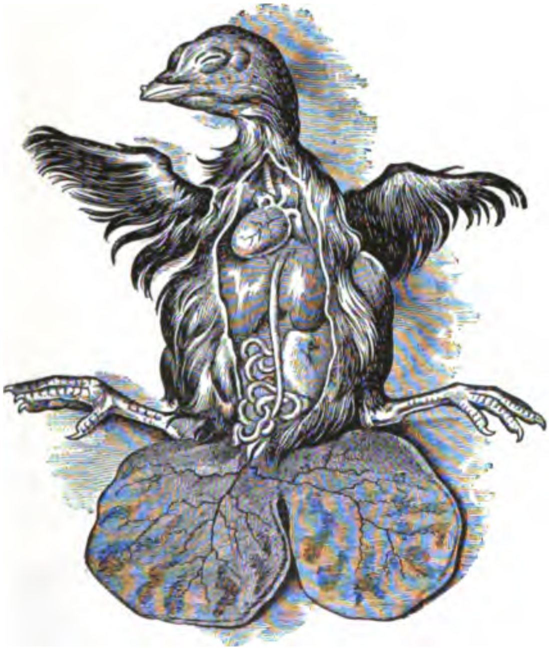


FIG. 8

During the twelfth and thirteenth days blood veins and arteries invade the entire structure, carrying colored fluid to the various parts of the embryo. Much of this development may be seen if the shell is carefully removed. On the fourteenth day the increased growth of the feathers is distinctly noticeable and the internal organs are well developed, as shown in Fig. 8. The chick at this stage has power of motion, and if removed from the shell will gasp for breath and the body and head will move. From the fourteenth to the twenty-first day the egg is so darkened by the growing chick that no trace of growth can be seen through the shell.

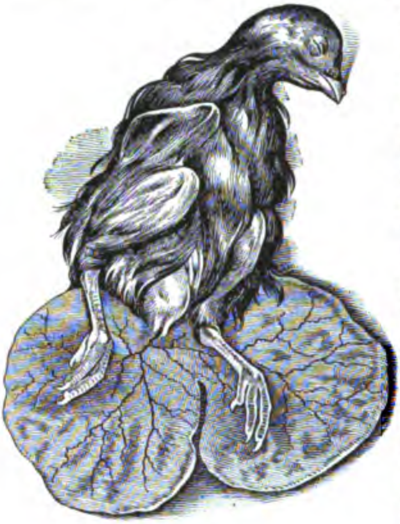


FIG. 9

From the fifteenth to the nineteenth day the chick continues to grow and to develop, and is fed at this stage from the yolk, which is attached to the umbilicus, or navel, as shown in Fig. 9. As the food material is absorbed from the yolk, the yolk takes up additional matter from the albumen, all of which is finally drawn into the yolk sac, as shown in Fig. 8. Gradually the entire yolk and its contents are drawn into the body of the chick, as shown in Fig. 10. This process should be entirely completed by the twentieth day, but unnatural conditions may cause portions of the yolk sac to protrude when the chick is hatched.

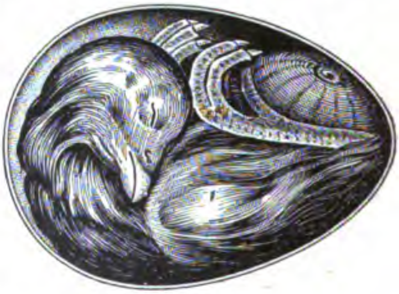


FIG. 10

14. Critical Periods in the Life of the Embryo. The periods near the third, seventh, fourteenth, and nineteenth days are critical periods in the life of the embryo. Marked changes occur at these dates, as has been stated. A slight mishap at any of these periods is disastrous to the life of the unhatched chick. Consequently, eggs that are being incubated should be most carefully handled throughout the incubation period.

15. Emergence of the Chick From the Shell.—Notwithstanding the fact that the natural period of incubation is 21 days, the eggs of Bantams are occasionally hatched on the nineteenth or twentieth day, and the eggs of Leghorns have been known to hatch equally early. For the most part, all young of the common hen hatch on the twenty-first day after the beginning of incubation. The head of the chick rests at the large end of the egg, as shown in Fig. 10. The end of the beak points to the shell, and there is a sharp-pointed scale or horn on the point of the upper mandible of the beak. With a motion of the feet the body is turned around inside of the shell; the motion of the head and wing pushes the sharp point against the inside of the shell and cracks it, causing small pieces to be broken from the shell, as shown in Fig. 11. The chick is free as soon as the circle is complete so that the parts of the eggshell will separate

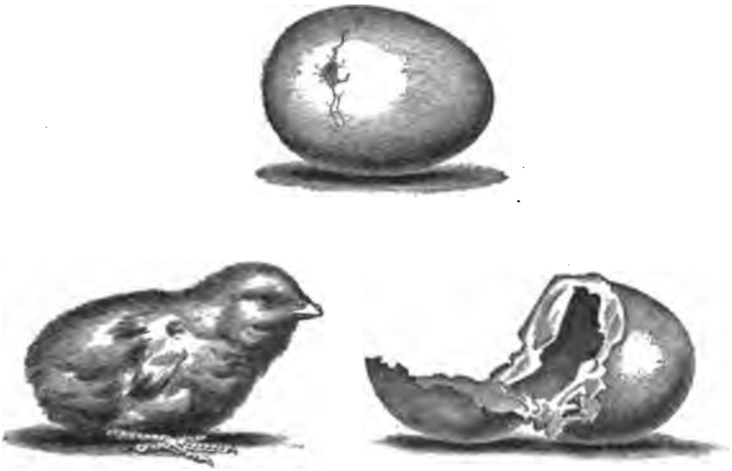


Fig. 11

and allow the chick to roll out. Some very active chicks will cut the shell in 6 hours, but the average time consumed for this is half a day. When the chick lacks vitality it may break through the shell, extend its beak through the opening and lie still until it becomes stuck tight to the inside of the egg; usually death ensues. The shell becomes very brittle as the result of incubation, and because of this fact it can be fractured very easily, thus enabling the chick to break the shell. Rough, heavy shells are not readily fractured by the chick—an additional reason for selecting smooth-shelled eggs for hatching.

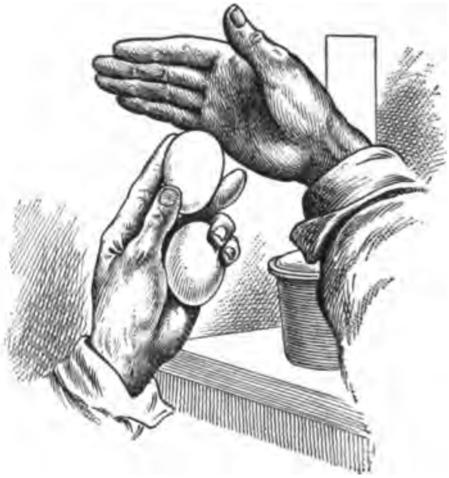


Fig. 12

16. Testing Fertility of Eggs.—After hen's eggs have been incubated for some time, it is usually desirable that they be examined for fertility. This examination should be made during the seventh day of incubation, and while the work of testing the egg can be done in daylight, it is usually well to do the work after dark. The egg may be tested without the aid of any appliance except a lamp. As shown in Fig. 12, the hand of the tester shades the lamplight so that the light transmitted through the egg may be apparent to the tester, or the light may be shaded by means of a card-board in which an egg-shaped hole has been cut, as shown in Fig. 13. No matter what method is used, the eggs that are infertile and in which the germs are dead may be quickly separated from the fertile ones, as the developing embryo appears as a dark spot in the otherwise clear white of the egg. The clear eggs should be removed, as further incubation of them is useless. It is generally advisable to combine

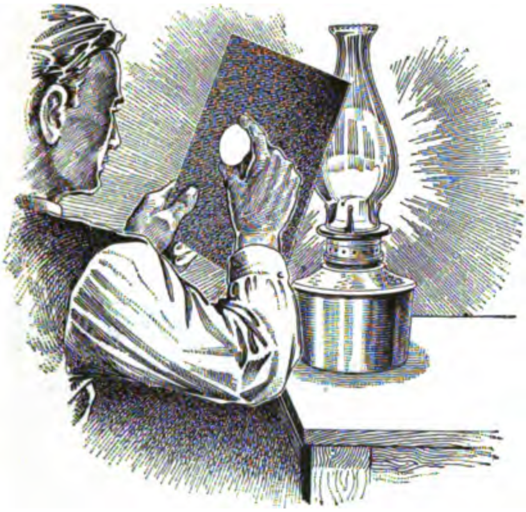


FIG. 13

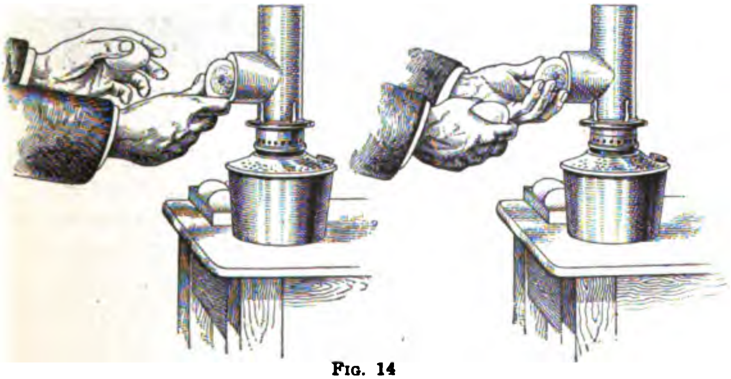


FIG. 14

the fertile eggs of three or four hens, placing them under two hens and supplying those hens from which the eggs have been removed with other eggs.

The use of bull's-eye lamps, or lanterns, as shown in Fig. 14, makes the work more efficient by magnifying the germ, thus emphasizing the difference between the living and the dead germs. When the egg is laid against the opening with the large end up, the air cell is seen at the top and the fertility or non-fertility of the egg is readily perceived. The egg must fit close against the rubber front so as to cut off the side light.

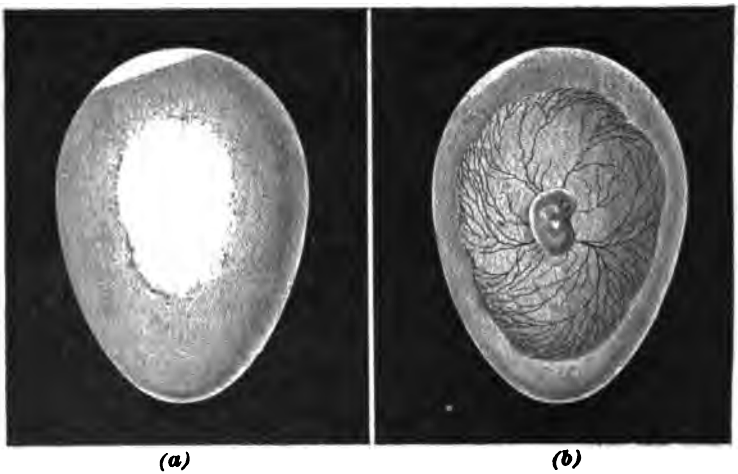

(a) (b)

FIG. 15

17. Signs of Fertility.--When held against the opening through which the light comes, the clear, or infertile, egg is nearly transparent, as shown in Fig. 15 (*a*). If fertile, the egg is opaque and the embryo is plainly seen, as shown in Fig. 15 (*b*). Some eggs show a brown shadow over the side as if a veil were interposed between the shell and the germ. The size of this apparent veil varies. Eggs that have thick, dark shells do not show the veil so plainly as do those that have thin or white shells. *Dead germs*, or spoiled eggs, show in several ways: the inactive or dead germ and the separate yolk are not clearly defined; the blood markings do not have venous outlines; irregular lines without connections are seen; and the entire egg structure lacks the definiteness of that of eggs that contain living embryos. With practice, the merest amateur becomes familiar with these distinctive conditions as viewed through the tester in a darkened room.

18. Size of Air Cell.—The size of the air cell of eggs varies so much in different localities and under different temperatures and weather conditions that the possibility of its being an absolute guide in the testing of eggs is removed. The air cells differ under hens and in incubators in the same room; they are not alike under different hens, and they differ under the same hens and in the same machines. The greater part of the moisture in an egg disappears as the hatching period approaches, and consequently the air cell becomes larger in size and acts as a cushion, or filler, that prevents the embryo from flattening out inside of the egg. The normal size air cell at different stages of incubation is shown in Fig. 16, in which the numbered lines refer to the size of the cell as seen on the fifth, tenth, fifteenth, and nineteenth days. An egg loses about 8 grains of weight per day during the first 18 days of incubation, the loss being due mainly to evaporation. As this loss occurs, the shell linings, or the inner and outer membranes, separate. This separation usually occurs at the large end of the egg, where the air cell is naturally and properly located.

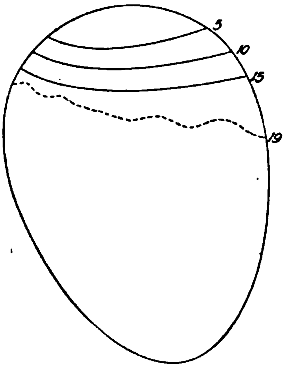


FIG. 16

Notwithstanding the fact that the air cell is normally located at the larger end of the egg, other air cells may form on the side of eggs that are not turned for several days prior to incubation or during the incubation period.

HATCHING WITH HENS

NESTS

19. Nests for sitting hens must be large enough to prevent the eggs from being crowded or piled one upon another. Nests carelessly made, as shown in Fig. 17, assure bad results; the eggs roll out and are broken or chilled. The depth of a poorly made nest is not sufficient to protect the eggs from below nor will it aid the hen by holding the warmth about the eggs. A comfortable nest can be made in a box laid on its side and filled with fine hay or soft straw, as shown in Fig. 18. A nest of this kind will do when the hen is by herself and is safely shielded from other hens that might disturb her while sitting. Nests in which hens are sitting must be protected

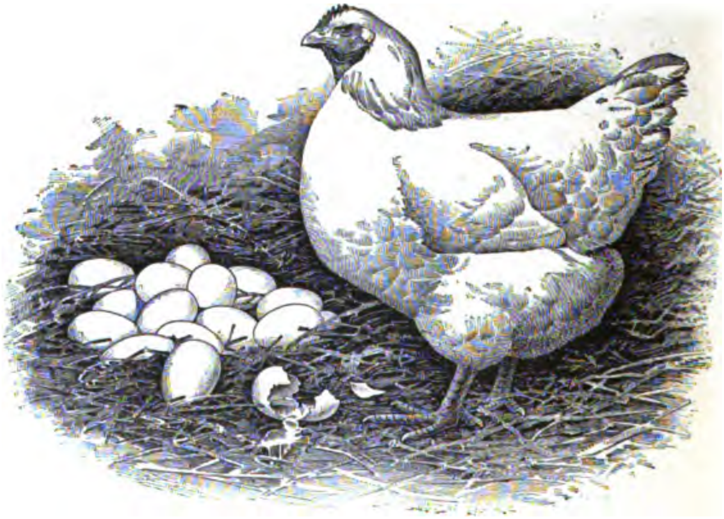


FIG. 17

against intrusion from other hens, for the sitting hens must have quiet and must be undisturbed while on the eggs. If the hens are disturbed they become nervous, move about, and break the eggs.

20. Box Nests.—Nests for sitting hens can be made in boxes which are at least 14 inches square; soap boxes answer the purpose well. A box 9 inches deep, 15 inches wide, and 18 inches long has about the correct dimensions. Good deep nests protect the eggs from the cold below. The entire box should be lined with soft hay, as shown in Fig. 19. The nest, as shown in Fig. 20, should be sufficiently deep to incline the eggs slightly toward the middle and flat enough to avoid crowding or piling the eggs. Several nests like this can be placed on the floor of a room and each nest may be occu-

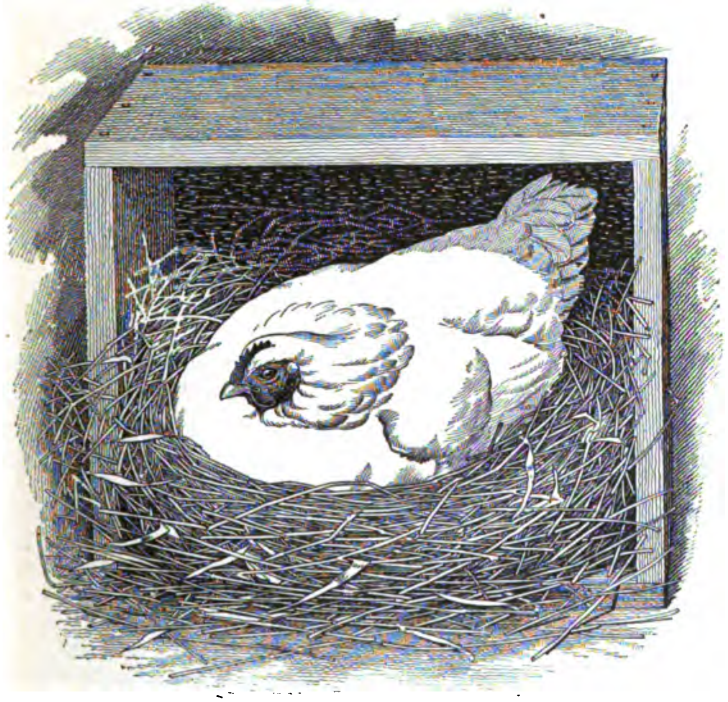


Fig. 18

pied by a sitting hen. When this is done, hens that are accustomed to being together should occupy the nests, otherwise fighting will occur; if the hens are strangers to one another, their nests must be enclosed and careful watch kept of the hens when they leave their nests.

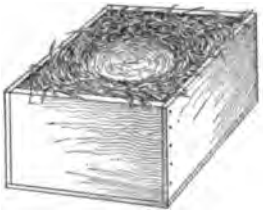


FIG. 19

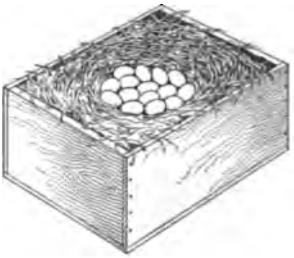


FIG. 20

21. **Barrel Nests.**—Barrels laid on the side against a fence and sheltered from the weather, as shown in Fig. 21, are useful as nests for sitting hens, as brood coops for the hen and her chicks, and, when not needed for hatching, as coops for broody hens. The nests for sitting hens should be made in the rear part of the barrel, and the food and water placed on the outside in front. When the nests are prepared in this way, the hens are safe from intrusion and are confined to the nest.

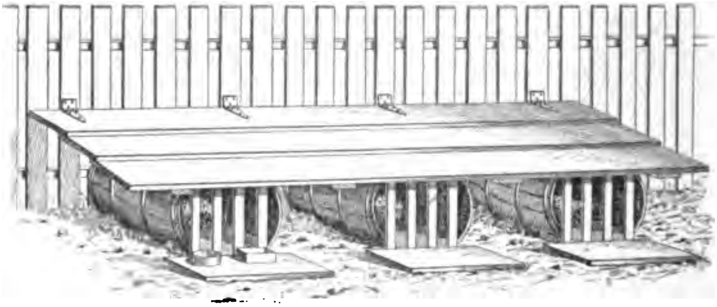


FIG. 21

Barrels set into the ground, as shown in Fig. 22, also make good nests for sitting hens. These nests are specially suited for warm, dry districts; the barrels, if filled with earth, draw moisture from both the air and the ground; the earth retains the moisture and warmth about the eggs and the nest can be made comfortable and free from vermin. A piece of oilcloth or heavy felt paper fastened over the top of the barrel and turned down over the opening shelters the nest from rain, shields the sitter from other hens, and secures her on the nest. Nests of this kind need shelter from the sun as well as from the rain. Numerous holes should be bored through the sides near the top to provide light and air.

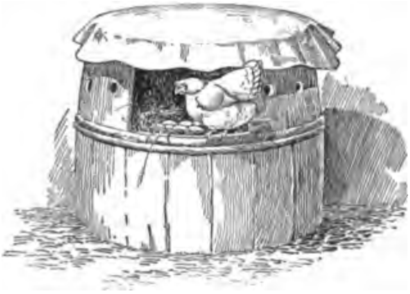


Fig. 22

22. Combination Nests.—Nesting boxes suited both for the sitting hen and for her chicks after they are hatched are economical of space. These boxes may be made singly, or in pairs, as shown in Fig. 23. In the latter case, two hens can sit at the same time, one on each side. When the chicks are hatched the nests should be cleaned and the hens and chicks may occupy them as coops. The whole front of the coop, which is really a door, should be fastened with hinges to the top of the coop; the slats *a* are sliding doors that push up when the front is closed, and through these doors the chicks can pass into the coop and out of it. Each single coop should be 24 inches square and at least 2 feet high in front. The greater portion of the front is made of wire cloth. These coops should be placed under a shelter

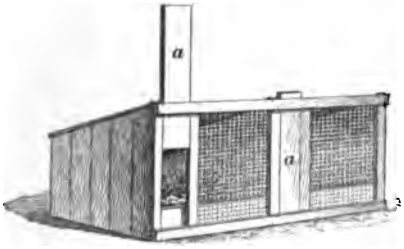


Fig. 23

like that shown in Fig. 29. The chicks may be kept under the shelter by means of a frame or fence made of 12-inch boards placed edgewise.

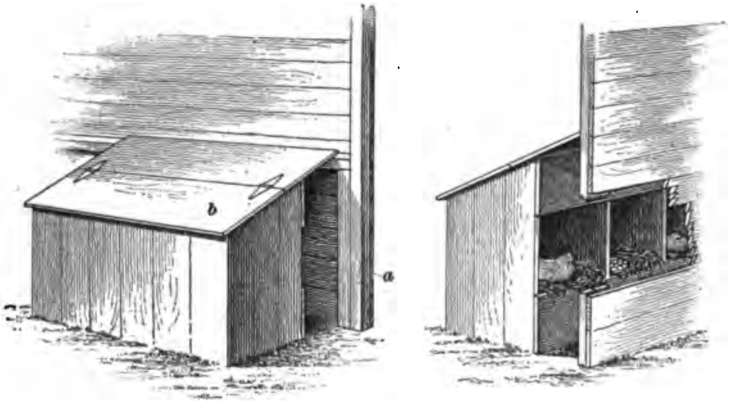


Fig. 24

23. Darkened Nests.—Sheltered or **darkened nests** built in the corner of a shed or hen house are perhaps the favorite nesting places for timid hens. In nests of this kind the most nervous hen will sit and hatch her brood. Such nests are suited also to game fowl. Hens may go to these secreted nests through an opening, as shown at *a* in Fig. 24. Each hen has her separate nest; the lid *b* on top is turned up when the hen and her nest are to be inspected. There are several kinds of nests for sitting hens that are suitable for use in small rooms.

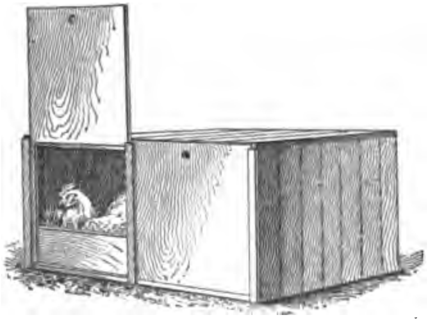


Fig. 25

24. Enclosed Nests. A number of hens may sit in the same room, provided the nests are so made that they confine the hens, thus preventing them from fighting or disturbing one another, and from leaving the nests too frequently, or from going to the wrong nests after feeding. Good types of **enclosed nests** are shown in Figs. 25 and 26. In using nest boxes of this kind the attendant should release the hens at a stated hour each day for a time long enough to allow them to feed, drink, and wallow in the dirt. Each nest should be closed as soon as the hen using it returns to her eggs. The front of the nest should be tight and the rear should be covered with wire screen or slats. The nest box should be placed far enough out from the wall to admit of light and air. Nests of this kind need to be 15 inches square, outside measurement.

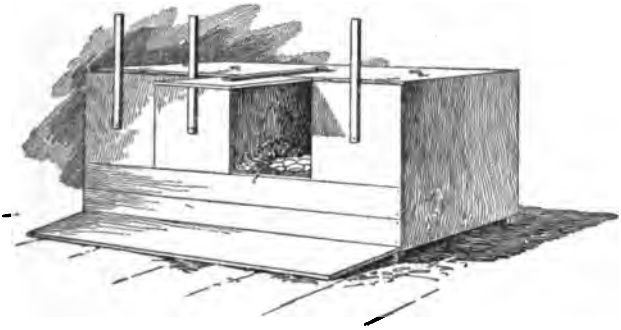


Fig. 26

25. Double-Tier Nests.—Shelf or cupboard nests may be used when the number of sitting hens is large. These nests are built two tiers high, as shown in Fig. 27. Frequently fifty or more hens may occupy a single room in **double-tier nests.** When nests of this kind are used, the hens are taken from the nests each day at feeding time and are returned to them after feeding. Nests of this kind economize space, but they are not so convenient as those that are set close to the

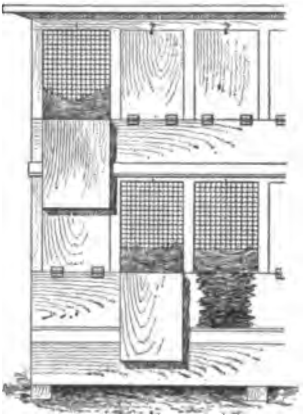


Fig. 27

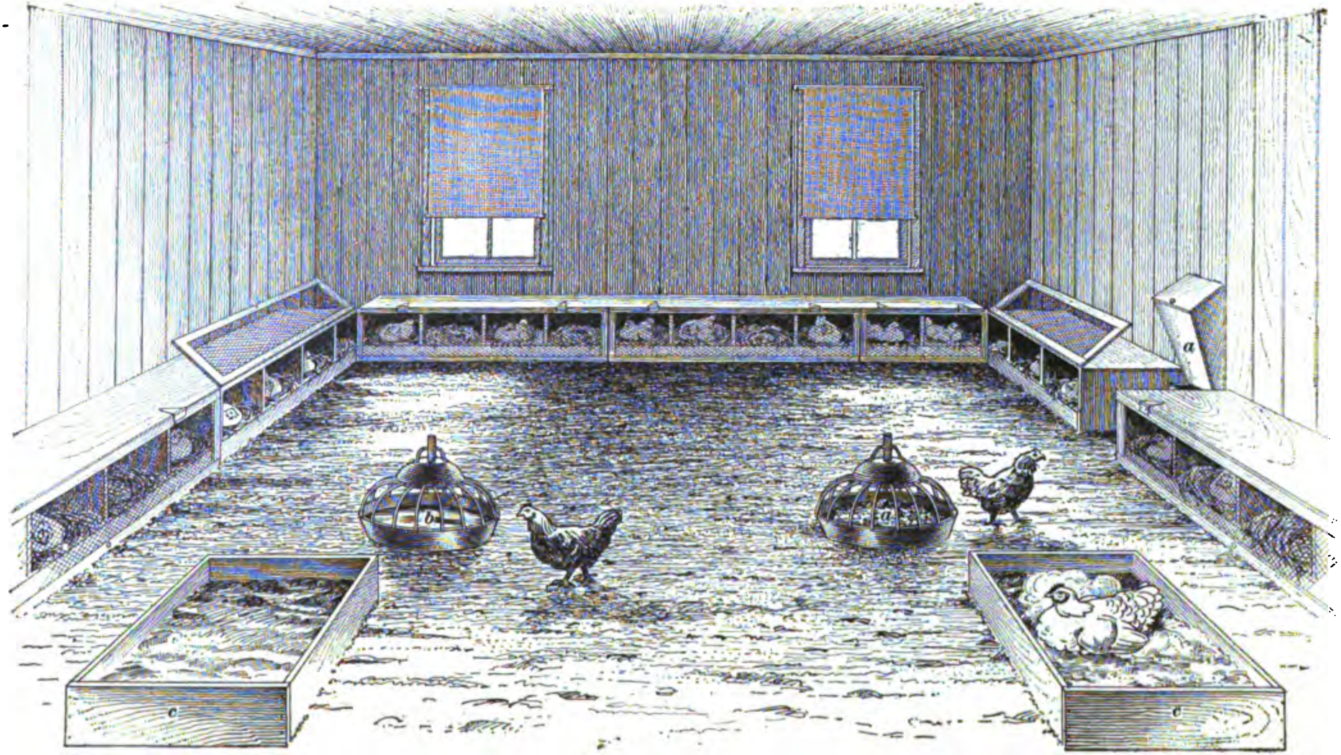


Fig. 28

ground. The backs of these nests should be covered with close-mesh poultry netting. The inside of the nest should be at least 14 inches square.

26. Room for Sitting Hens.—Rooms may be equipped for sitting hens by placing nest boxes on all sides, as shown in Fig. 28. The nests are enclosed with wire-screen fronts, which should be removed each day to allow the hens to leave the nest to feed. The feed hoppers *a* are filled with corn and wheat, and the pan *b* contains a plentiful supply of water. The boxes *c* on the floor are filled with fine dry earth, in which the hens dust themselves. The floor should be covered with earth, which should be raked over each day and thoroughly cleansed from filth. The nests are filled to the depth of 2 inches with damp soil that is well pushed into the corners and against the sides. Each nest is made large enough to hold the eggs together without crowding. The nest is lined along the sides with soft straw or hay, and the middle filled in with fine short-cut hay that is shaped into form as shown in Fig. 20. When finished, the nest must be thoroughly dusted with very fine tobacco dust or insect powder.

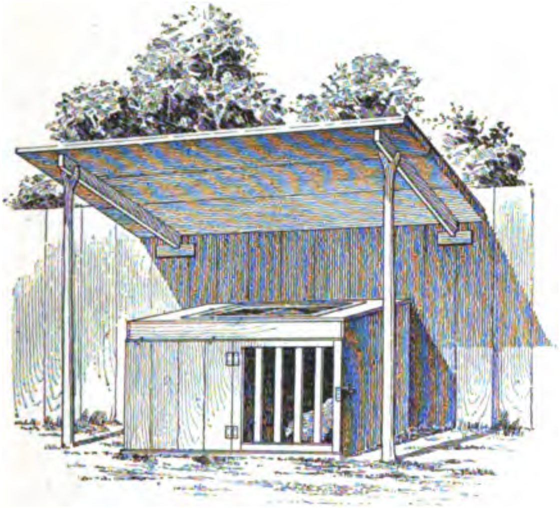


Fig. 29

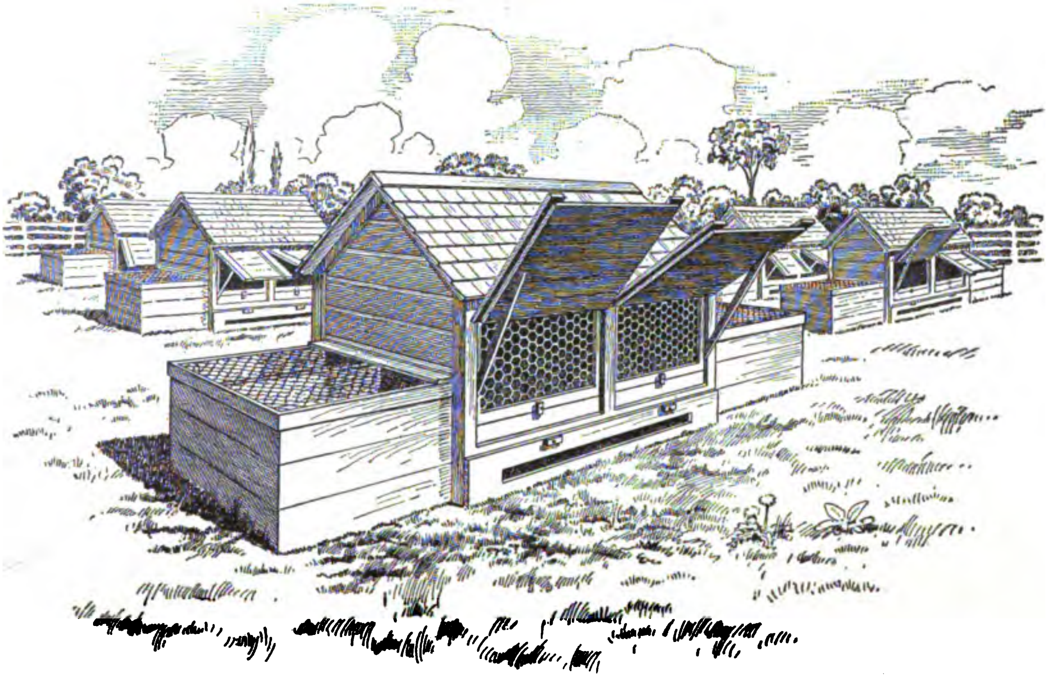


Fig. 30

27. Nest Shelters.—Nest coops under a shelter, as shown in Fig. 29, are safe places for sitting hens or for hens with chicks. The coops can be made to fit the space they occupy, and shelter and coop can be made large enough to shelter several hens. The nest on which the hen sits is in the enclosed part; the food and water for her use are placed inside the slats. The opening on top is closed with glass when the weather is cool or cold; during warm weather the glass is removed and the opening is closed with fine wire screen, which permits ventilation. **Nest shelters** may be placed against a fence or outbuilding facing the south. They may also be used for outdoor brooders, and as roosting places for half-grown chicks during hot nights.

28. Colony Coops.—Small **colony coops** are also used as nesting places for hens, as brood coops for mother hen and chicks, as colony coops for the growing pullets, and as living coops for the market poultry. These coops are made in convenient sizes; those shown in Fig. 30 are 5 feet wide and 7 feet long; they are low-built and cheap but substantial. At each end are the outdoor runs for the sitting hens, or for hens and chicks. These coops have board floors, and when used for sitting hens are divided into four spaces. One hen, or even two hens, can sit in each of the four parts. Each hen has the freedom of the inside space allotted to it and of one of the outside runs. All hens in each house are set at the same time, and when the chicks are hatched the whole number should be given to as few of the hens as can properly care for them. The partition should then be removed from the house and the whole floor space allotted to the hens and chicks. Coops of this kind are used where market poultry is grown on a large scale. A number of these coops can be placed in the open field, where the chicks have absolute freedom to wander at will after separation from the hens.

29. Nests in the Open.—If possible, the setting of hens in buildings used continuously by poultry should be avoided, for the chief loss with sitting hens comes from setting them in hen houses infested by hen lice and red mites, or where they can be interfered with by other hens. Untold losses from many causes occur on farms where hens roost, lay, and sit in the same building. These losses can be prevented by setting the hens under a barn or porch, or in an outbuilding other than the hen house. Wooden boxes out in the open and sheltered with boards are better places for sitting hens than ordinary hen houses. A coop and run for four sitting hens, like that shown in Fig. 31, may be made from two boards 8 feet long set on edge and fastened together. In this coop, each hen has a nest *a* 15 inches wide and 2 feet long, and the freedom of the open run. The top of the run is covered with poultry netting or lath; the nests *a* are filled with earth enough to afford good drainage. The surface drainage should be away from the nests.

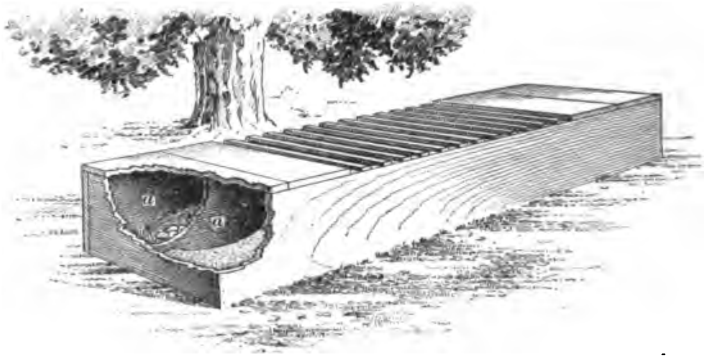


Fig. 31

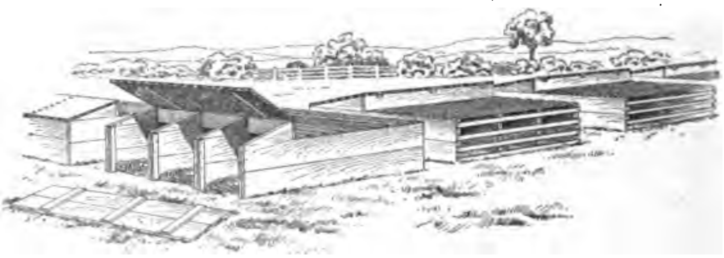


Fig. 32

For convenience of management, another type of separate nests and runs is sometimes used for sitting hens. These nests, which are 2 feet or more in height in front, are constructed as shown in Fig. 32. The floor of these nest coops should not be of boards, as the ground is preferred. The top of the coops is hinged in front to admit of opening. The runs are enclosed with plastering lath and each group is 4 feet square, thus giving each hen a run 15 inches wide and 18 inches high in the rear. The nest coop is filled in with damp earth; the nest is made on top of this earth and the hen is permitted to go and come at will from the nest coop into the small run. Sitting hens are safely confined and away from danger if treated in this way. These same coops and runs are suitable for the hens and chicks after hatching.

MANAGEMENT OF SITTING HENS

30. Broody hens that are quiet and tractable should be selected for hatching purposes. Those that are wild and unmanageable are not suitable for sitting or for mothers after the chicks are hatched. The use of hens with scaly legs should be avoided, as this ailment is liable to be transmitted to the chicks. Hens that are to be set in the same room should all come from the same flock. Before the hen is placed in position, the nest should be thoroughly dusted with insect powder and body of the hen covered with it. The powder should be well worked in down to the skin and the work should be done with especial care about the vent, under the wings, and about the neck. This operation is repeated on the seventh and fourteenth days of the incubation period. In this way only are vermin kept from the hens and the chicks saved from their ravages. Non-fertile, or clear, eggs should be placed under the hen for 2 or 3 days to test her. If she is faithful and attentive to these, she may be trusted with a lot of selected eggs; if she pushes them under her body with her head, it is a sign she is a good sitter.

31. Care of Nest and Hen.—To dust the hen and nest with insect powder is fatal to body lice, and red mites may be kept away with kerosene oil or turpentine; 2 pounds of naphthalene flakes dissolved in 3 gallons of kerosene oil makes an excellent application to keep the latter pest away from the nest boxes. If this solution is liberally used in cracks and crevices of nest boxes, there will be very little trouble from mites; and where mites are abundant this preparation should be freely used on all the woodwork of the nest every time a hatch is taken off. When the day of hatching arrives the nest is flattened out in order to make more room, for if the eggs are crowded too close together the chicks are liable to be smothered as they emerge from the shell. The hen and chicks should not be removed from the nest until the second day after hatching begins, nor should the chicks be fed until the third day after the hatch begins.

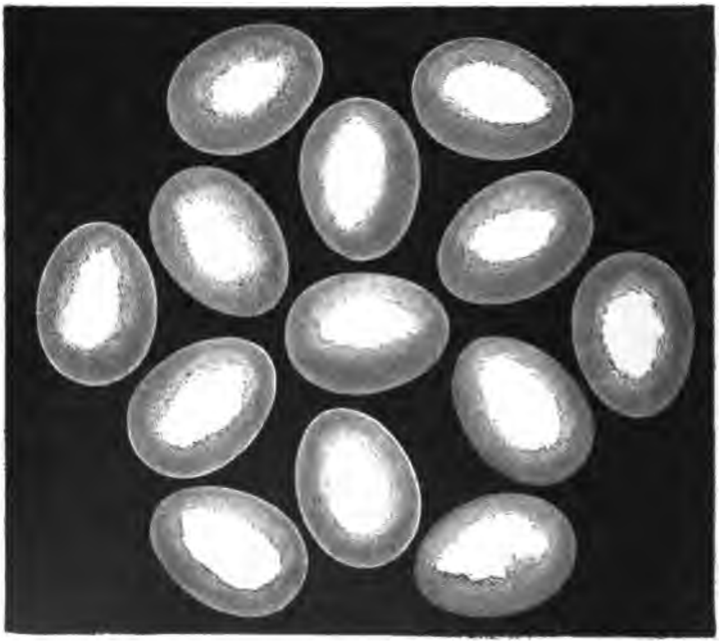


FIG. 33

If the nest is to be used again, all the old nesting material is removed and burned and the nest box itself well cleaned before making another nest of new material.

32. Number and Arrangement of Eggs.—A setting of eggs should consist of an odd number, because an odd number fits better in the nest than does an even number. Thirteen eggs are generally considered as a setting, and they are arranged in the nest as shown in Fig. 33. The eggs should be uniform in size, for if some are small and others large the body of the hen will not come close to the smaller ones and the temperature of the eggs will not be uniform. Eggs of irregular size, as shown in Fig. 34, are unfit for incubation.

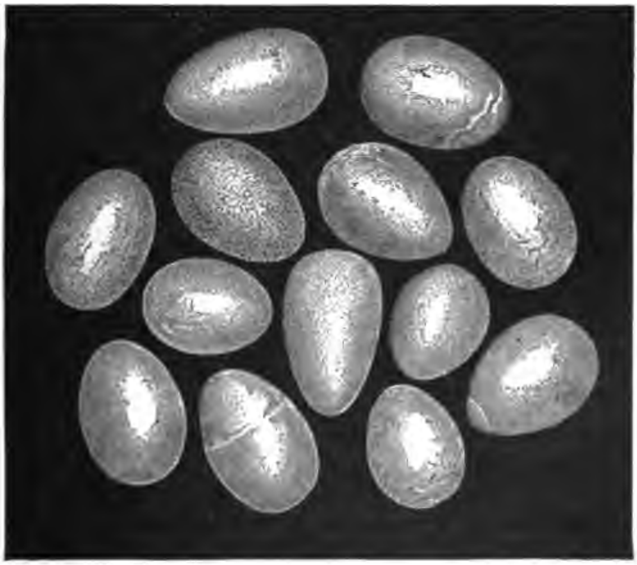


FIG. 34

Eggs of this kind seldom, if ever, produce perfect chicks. Eggs set under hens gain a smooth gloss from contact with the body of the hen. By this means, as the process of incubation advances, the pores of the eggshell are closed.

33. Moving the Broody Hen.—Broody hens that have quiet dispositions can be moved anywhere and may be actually placed on the nests if they are properly handled. To move a sitting hen, place the left hand gently under her breast bone, and take the shanks in the right hand with one finger between them. Clasp her firmly but gently; raise her from the nest, holding her against the body with head toward you and the tail away from you. Do not carry her by the shanks, head hanging down. Place the hen gently on the nest, in which should be a few test eggs; settle her quietly with one hand on her back, the other smoothing her head—just a little of this—then remove the hands and cover or close the hen in the nest. If she settles down at once on the nest and turns the eggs with the motion of her body and wings, moving has been successful; if she is restless, shut her in the nest and do not disturb her until morning. It is always best to move brooding hens at night. If the hen takes quietly to the nest and eggs, as she is apt to during the night, let her remain undisturbed during the day until an hour before sundown, then permit her to come from the nest for food and water. If she refuses to sit during the night and day, she had best be returned to the flock of hens.

34. Care of Sitting Hens.—If the hen is quiet and willing to sit, dust her body with insect powder as already described and let her stay the second day on the nest, permitting her to feed before noon of the second day. If she returns to the nest herself, all is well; if she does not do so, place her on the nest again. After 2 days of proper behavior on the part of the hen, dust the nest and the hen's body again with the insect powder and place an odd number of eggs in the nest. Some hens can cover thirteen eggs, others only nine or eleven. Do not crowd too many eggs into the nest. for the good returns come from too few rather than from too many eggs in the nest.

Broody or sitting hens must be kept quiet and undisturbed except at feeding time, which should occur at the same hour each day. This statement refers to hens that are confined to their nests. Hens that come and go at will should have food and water close at hand, from which they may help themselves at any time. Corn and wheat with grit and shell are perhaps the best foods for sitting hens; fresh water should also be provided each day. A dust bath is a necessity for health and cleanliness. If any eggs are broken in the nest, they should be removed without delay, and the nest should be cleaned. If the eggs in the nest become soiled they should, if possible, be cleaned without washing them. This cleaning may be done by scraping them with a dull knife or with the thumb nail; if washing is indispensable, the eggs must be immersed in water the temperature of which is 90° F. or a little less—not more; the dirty coating on the shell should be softened and removed with as little rubbing as possible. When the nest and eggs have been cleaned, the eggs should be replaced under the hen. Eggs that have been washed do not hatch as well as those that have not been so treated.

35. Feeding the Sitting Hen.—Hens that are sitting must be regularly fed on good solid grain. They should be given at each feeding grain enough to last them 24 hours. Whole corn that is dry and hard, wheat, and some shell and grit must be supplied. Hens that cannot come from the nest at will should be liberated or taken from the nests to feed. Their crops must be felt each day, for if not plentifully fed the hens will lose fat and their temperature will decrease, with the result that the eggs will not be properly warmed. When the hens come and go from the nest at will, food, grit, and water must be placed where the sitting hens can help themselves and at the same time be out of the reach of other hens. Looseness of bowels at this time is to be avoided, as such a condition weakens the hens and lowers the temperature of the body. In returning the hen to the nest, she should be placed on the edge of the nest and be permitted to settle on the eggs as she will; she should never be forced or hurried.

HATCHING PERIOD

36. Need of Moisture.—When the nest, the ground, and the air are all very dry, it is customary to moisten the nest or the eggs as the hatching period approaches; this work usually being done on the nineteenth or twentieth day of incubation. Whether or not this practice is beneficial in natural incubation is a matter of dispute, but there is no doubt that moisture, properly applied, is advantageous in artificial incubation. If the practice is followed in natural incubation the nest may be moistened by sprinkling the ground or floor about it, or by pouring water down the inner sides of the nest box. The eggs themselves, however, should never come in contact with cold water. If the eggs are to be moistened directly, the water used should first be brought to the same temperature that the eggs are; then they may be sprinkled or the moisture may be spread over them with a soft brush.

37. Breaking the Shell.—The chick breaks the shell from within, and while the mother hen does not assist in this, she sometimes removes the broken shells from the nest. She, however, takes no part in breaking the shell or in releasing the chick from it. As the chick turns about within the shell, the movement of the head forces the beak against the shell on the inside, and the hard point on the end of the beak chips the shell and cuts a circle out of the large end of the egg, as shown in Fig. 11. Through this the chick rolls out into the nest. Weak chicks break a hole through the shell, push their beak through the break in the shell, and frequently stick fast to the shell and die. If by any chance the shell is crushed, the chick will adhere to it and die. Heavy hens may crush the shells, especially if the eggs are piled or crowded in the nest. There is little advantage gained in helping the chicks from the shell, and it is a cruel practice to remove the hard scale from the point of the beak after the chick is hatched; nature removes it at the proper time.

When the chick within the shell begins to peep, the mother hen is apt to resent intrusion, even though she may have been tractable prior to this time. In this case her confidence may be regained by gentle treatment, provided she is not a bad-tempered hen. Hens that are naturally cross or bad-tempered are fit neither for hatching nor for brooding the chicks. Whenever ill-tempered hens have been used by mistake, or for want of more suitable ones, the eggs should be removed and placed under more quiet hens as the opportunity to do this occurs. Bad-tempered hens have little value as mother hens for the chicks; they are apt to kill both their own chicks and those of other hens. Chicks do best when they are given to quiet, motherly hens to brood.

38. Doubling the Broods.—As has been stated, space and time and labor in caring for them may be gained by setting a number of hens from the same flock in the same room at the same time. More time and labor may be gained after the chicks are hatched by **combining the broods** and by giving as many chicks to each hen as she can properly care for. Three fairly large, quiet, and motherly hens may be put together in a large coop and they may care for as many as forty-five chicks. Wild, cross, timid, or nervous hens, however, should not be put together in this way, as trouble will surely follow. Some hens care for large broods better than other hens for a few chicks. Hens cannot brood large numbers of chicks during cold, damp weather, because the chicks are apt to be chilled for lack of room under the hen. During warm weather, more chicks can be brooded by one hen. When broods have been doubled, the hens not needed to mother chicks may either be set again or returned to the laying pens.

When two or more hens are confined with large broods, there is less time consumed in caring for them and in feeding them than would be the case if each had a separate brood; there is also less space occupied than is necessary for separate small broods. As the chicks grow and mature, they require less brooding and fewer hens will care for their needs. When several hens are together in roomy coops with large broods the hen that is the least motherly should be removed after the chicks are fairly grown, after which her chicks will flock about the other hens. This cannot, of course, be done with separate hens and separate broods. Where a few chicks are grown, the separate brood coop with mother hen and brood is best; but where a large number are grown, it is best to have large brood coops that can be used for four sitting hens, and also serve as brooding quarters for the hens and the chicks.

YOUNG CHICKS ON THE FARM

39. The most satisfactory results are obtainable with poultry that is properly grown and cared for on the farm. Nowhere else can poultry be grown so economically. The cost of building and the care and attention needed are trifling when compared with the possible profits. Quite frequently, however, even favorable farm conditions are nullified by neglect, and failure results in cases where success is within easy reach. Intelligent and unremitting attention are the prerequisites to success; without such attention nothing worth while, even in poultry growing, is possible.

Chicks do best with natural environment; for, if well protected, they grow more quickly under such conditions than when they are kept or brooded on the ground used for this purpose year after year. Brood coops with hen and chicks placed along the fence rows close to the corn field, on the edge of a grove, or under berry bushes, are well located, provided there is protection from flying or prowling enemies.

Chicks prosper when grown on land that has recently been plowed; in the furrows of corn fields, in a meadow, or in a berry patch. The branches of well-grown asparagus furnish admirable shelter for them; and chicks grow to perfection in fence corners and beneath the shadows of a wood lot or an orchard. Tainted soil or land frequented by grown poultry is not good for chicks; such an environment retards growth, reduces vitality, and causes liver trouble. With equal care and comfort on both kinds of soil, chicks will make better growth in 3 months on freshened soil than in 5 months on tainted land.

40. Brood Coops in the Corn Field.—If the chicks are to have the run of the corn field, the placing of brood coops is accomplished by moving the brood coop, hen, and chicks into the field, as shown in Fig. 35, or by placing the coops along the fence of the field or under the shelter of a near-by tree. This moving is done when the chicks are a week or 10 days old. When the season has advanced far enough for the growing corn to furnish shelter, the brood coops may be moved into the corn field where no harm will be done the crop if the hen and her chicks have the free range of the fields. Hopper feeding is advisable under these conditions. The feed hopper *a* is filled on one side with dry mash, and on the other side with cracked corn, whole wheat, and hulled oats. Meat scrap is not needed, provided that bugs and worms abound on the range. An ideal range would consist of an open meadow next to the corn, with a wood lot to the rear. Chicks grown in such an environment are large and vigorous, and possess a profuse growth of glossy feathers.

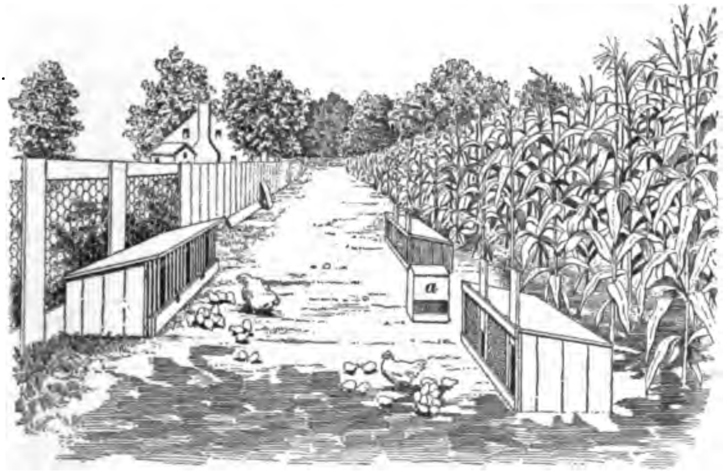


Fig. 35

41. Natural Shelter.—Rough, untillable land overgrown with brush, bushes, vines, and small trees also makes an ideal range for a hen and chicks. The short growth protects them from the sun and rain, and hawks and other flying destroyers do not readily find the chicks that enjoy such shelter. Brood coops made of large wooden boxes, as shown in Fig. 36, can be used. These coops are so placed as to have the shelter of the undergrowth; in them the hens hatch and rear their broods, away from the annoyance of other hens and on uncontaminated ground. The danger of such a location is from weasels and other vermin that kill. A watchful collie or terrier dog will guard the flock from danger during the day and at night the coops, which should be tightly made, should be carefully closed. The chicks so confined within the coops at night should be liberated after sunrise; and when the chicks are 3 weeks old, the hens as well as chicks should have free range after the sun has dried the grass. Young chicks can run through the damp grass with very little injury so long as the hen is in the coop to warm them if they become chilled, but they cannot follow the mother hen through damp grass without becoming injured by the cold and wet.

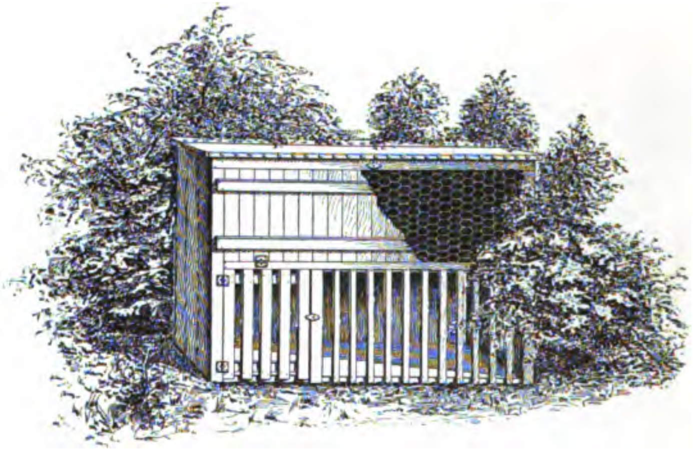


Fig. 36

42. Common Faults in Brooding.—If boxes and coops that are too small are used for the mother hen and chicks, it often happens that chicks are killed by the mother hen because she has little room in which to move about. Open-bottom coops set in low places permit moisture and mud to collect, thus frequently causing the death of young chicks. If coops cannot be securely closed, the mother hen will wander away with her brood, and if the event occurs when the grass is wet, many chicks may be lost. Coops placed near board piles, barns, or outbuildings attract rats, and board floors that are elevated slightly above the ground furnish a hiding place for such destructive vermin. Neglected coops make admirable breeding places for lice and mites, and an infected soil keeps the brood in constant danger from disease. Neglected coops soon become filthy, and if the chicks eat the feed thrown into such quarters their health is soon undermined. Cleanliness, sunlight, good air, and plenty of room are indispensable both for the mother hen and her chicks.

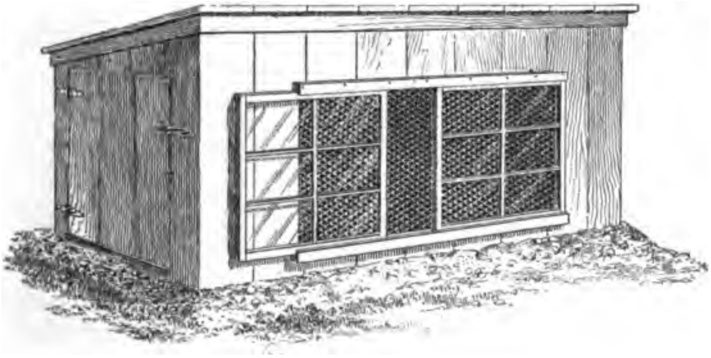


FIG. 37

43. Early Broods.—The chicks that are hatched early in the spring should be kept with the mother hen in coops placed inside of a building or under the shelter of an open shed or building. Young chicks do poorly if exposed to cold or damp. For the first 3 weeks of their lives the early chicks will prosper on a board floor; if the floor is covered with earth or sand they will do still better. But if they are kept on board floors and away from the ground for longer than this, their plumage droops and weakness in the legs is apt to develop. Early broods are best grown in large brood coops, as shown in Fig. 37. In such coops they do remarkably well, provided that the floor of the coop rests on the ground and dirt is banked up all around the outside. Preparation for this work is made in the fall before the ground is frozen. The floor inside of the larger coop should be covered with dry earth. Coal ashes with the coarse material sifted out furnishes a dry footing for the chicks.

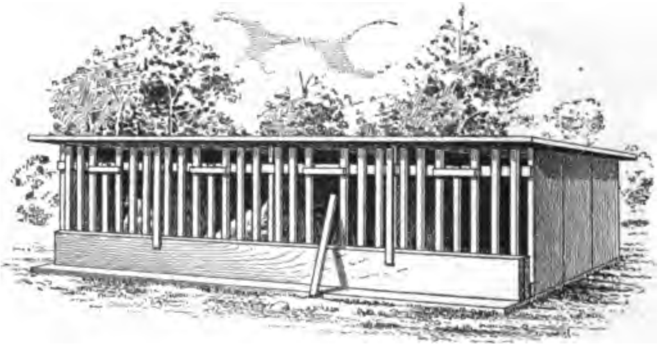


FIG. 38

Wood ashes are not suitable for this purpose. Four hens can be set inside of a coop of this kind and when the chicks are hatched all should be given to two hens to brood. Small brood coops, one for each hen, are placed inside the large coop; the mother hens are confined in these at night and during cold days, until the chicks are partly grown. The windows slide both ways and permit a free circulation of air, thus preventing excessive heat inside when the sun shines. If the wind blows strongly and is cold, a muslin curtain is placed between the open sash over the wire screen. Fresh air at all times is valuable to the chicks, but wind blasts should be avoided, and overheating may suffocate the chicks.

When the weather becomes warm, the hens and chicks do best if kept partly sheltered in coops that are dry and open to the air. Coops that have these qualifications may be made in four sections, as shown in Fig. 38. Each coop is 2 feet square and 2 feet high in front; the roof projects in front so as to afford shelter from the sun and rain; the board in front at the bottom of the slats prevents the chicks from coming out, while the boards forming the bottom keep the chicks from the ground. The floor of the coop should be covered with coarse, sharp sand overspread with a little chaff. In these coops the hen and chicks are kept until the chicks are nearly 2 weeks old, when they are moved into more open quarters, such as are shown in Fig. 39, where the hen can be on the ground and yet confined. The rear end of the enclosure is an enclosed **A**-shaped coop to shelter the hen and chicks at night. The slatted enclosure is an extension of the coop and it forms a yard for the mother hen. The chicks have freedom to go about but the hen is restricted in her movements. The coop is 3 feet wide at the bottom, 2 feet high, and 2 feet deep. The slatted run is 4 feet long. The entire coop is made in a single piece and may be moved from place to place so that the chicks may always have fresh ground.

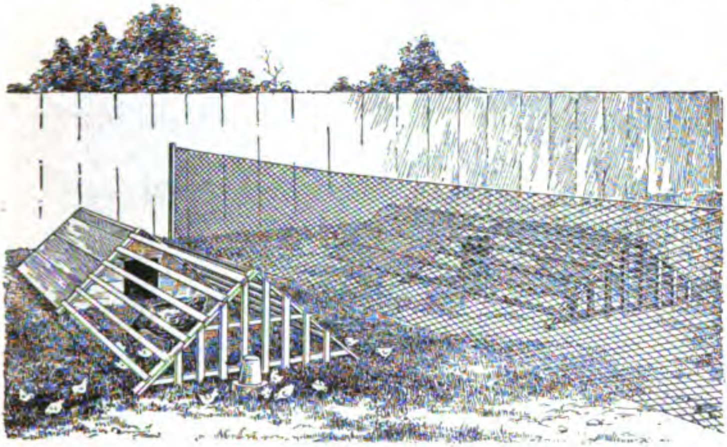


FIG. 39

44. Winter Brood Coop.—The **winter brood coop** shown in Fig. 40 is warm and comfortable during the most severe weather and is large enough for two hens and their chicks. The coop is sunk 3 or 4 inches into the ground, and is filled inside with dry soil. The earth is banked up around the outside. The hinged portion of the roof turns over, so that through the opening thus formed the hens, chicks, and coop may be cared for. The chicks can run from the coop out into the glass enclosure, the glass sash of which should be slightly raised to prevent overheating inside when the sun shines on the glass. A close cover of boards should be placed over the glass at night, also during days of snowfalls. This coop may be of any reasonable size, but should be no more than 2 feet high at the highest point. .The glass shelter is made to fit the glass used, and the floor dimensions of the coop correspond with the size of the sash.

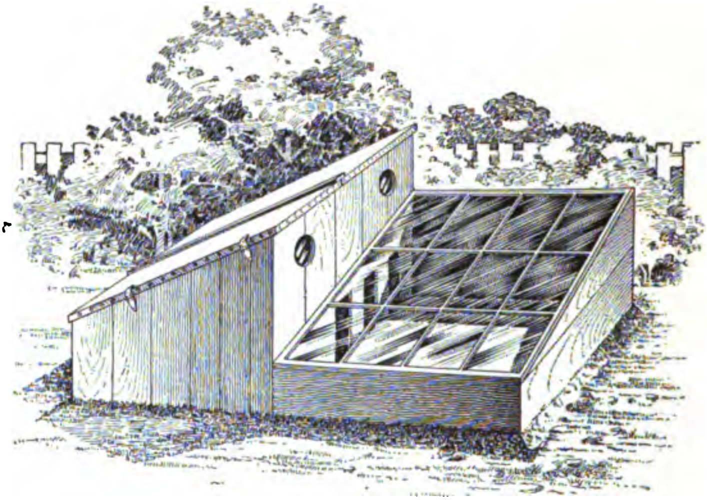


FIG. 40

NATURAL BROODING

BROOD COOPS AND SHELTERS

BROOD COOPS

1. **Brood coops** should be built with reference to their suitability for the locality in which they are to be used. Those best adapted to a northern climate cannot be used in the tropics; and coops that are best suited for winter may be entirely too close for use in summer; and while the ground may frequently be used as a floor, such a floor will not be satisfactory in a low, damp locality. The fresh-air supply is of prime importance. Small, confined quarters, or coops that are badly ventilated, are unfit for chicks, for they cannot endure cold or damp from which there is not frequent relief. Dry, comfortable, well-ventilated coops are best, although too much heat, like undue exposure to the cold, is injurious to the chick. Several of the coops described in *Natural Incubation* are excellent; but if they are misused, poor results may be expected. It is just as important that the coops receive proper care as that the right kind of coop be selected. The glass front in coops that are provided with them should not be left closed down throughout the day.

2. **Coops With Enclosed Runs.**—To protect the chicks from cats, rats, and other predatory animals, and from birds of prey, **coops with enclosed runs** are indispensable. These coops are made in many shapes and sizes; some kinds are used for a single hen and her brood, other kinds are adapted for two hens and a large number of chicks.

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The **apex coop** illustrated in Fig. 1 is frequently used without a board floor, and where the ground is continuously dry this fixture is not desirable; but where a floor is necessary, a movable one of thin boards may be used. Coops intended for both hens and chicks are from 34 to 30 inches high at the highest point and 2 feet square or larger. The enclosed run can be made of convenient size. As this style of coop is moved frequently, the run need be only large enough to permit chicks to exercise.

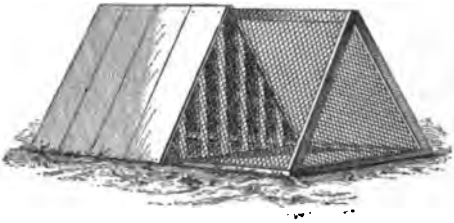

FIG. 1

A better kind of apex coop is shown in Fig. 2. The enclosed run of this coop is movable and is 2 feet wide and 3 feet long; the coop itself is 24 inches square and 2 feet in height at the peak of the roof and has a board floor. A movable frame made of slats serves the double purpose of a door to the coop and a passage through which the chicks may pass at all times. The mesh of the wire netting used to cover the runs must not be larger than ½ inch; if it is larger, rats may enter them and cats may claw at the chicks inside the runs.

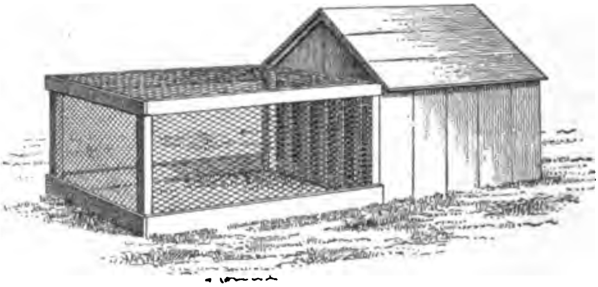

FIG. 2

3. Box Coops.—The **box coop** is useful for sheltering early broods, for delicate chicks, and for Bantams. The one shown in Fig. 3 resembles a small house, one end of which is an enclosed run, while the other serves as a brood coop for the hen. This coop can be made of any convenient size and is sometimes not more than 18 inches wide and 30 inches long. A board floor extends under the entire coop. The galvanized-iron wire cloth that encloses the run should be of small mesh, strong and durable. The coop is cleaned through the door *a*, and the chicks go in and out through the front opening *b*. For Bantams, the coop is made low; for larger fowls, about 24 inches from the floor to the peak of the roof and proportionately large throughout all dimensions.

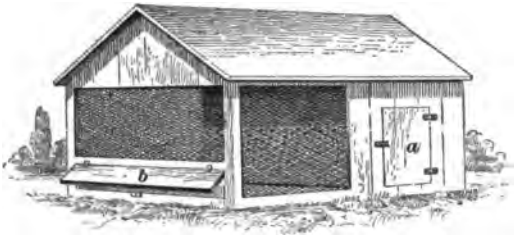

FIG. 3

A large box coop with enclosed run of the type shown in Fig. 4 is about 3 feet square, with a run of equal size or larger. The hood in front of the coop protects the hen from sun and rain. This coop is intended for two hens and a large brood of chicks, and it may or may not be furnished with a board

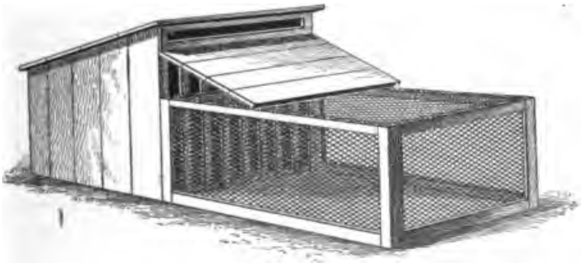

FIG. 4

floor as a protection from dampness. By moving these coops from place to place, fresh runs are secured for the chicks. This style of coop made larger and placed on runners may be used as a colony coop for growing chicks.

4. Large Brood Coop.—A brood coop that will house three or four hens and their broods may also serve a useful purpose for hatching. Fig. 5 represents a strongly built **large brood coop** 6 feet long, 3 feet deep, and 3 feet high in front. The upper part of the front is enclosed with wire netting, the lower part with strips of wood. The board doors close over the slats, which may be removed when the chicks are large enough to run about with the hen. Fifty or sixty chicks can be accommodated in a coop of this size; six of these coops will suffice for 300 chicks after they are weaned. The board floors should be covered with earth or sand, which may be cleaned away quickly when necessity demands. Such coops are warm enough for cool weather and may be opened for ventilation when the weather is warm; if roost poles are set in place, the chicks can continue to occupy the coops until winter.

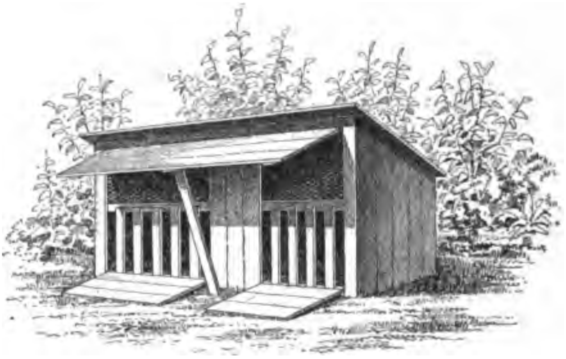

Fig. 5

During the summer months, coops of this kind partially hidden by the bushes and weeds serve in the daytime as a place in which the hen and chicks may find shelter from the heat and rain and protection from the birds of prey. The lower doors should be closed at night to protect the inmates from nocturnal prowlers.

5. Single Brood Coop.—When thousands of chicks on a single plant are to be brooded by hens during the summer months, **single brood coops** like those shown in Fig. 6 may be used. These coops are 28 inches square and are substantial, simple, and inexpensive in their construction. In the front end is a sliding sash or door so that the newly hatched chicks may be kept inside with the hen; as they grow larger, the sash may be opened enough to allow the chicks to pass through at will while the hen is confined. When the chicks are old enough they can roam at will with the hen during the day. Coops like these may be scattered over fields, as

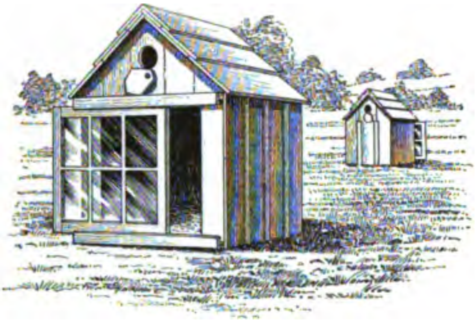

FIG. 6

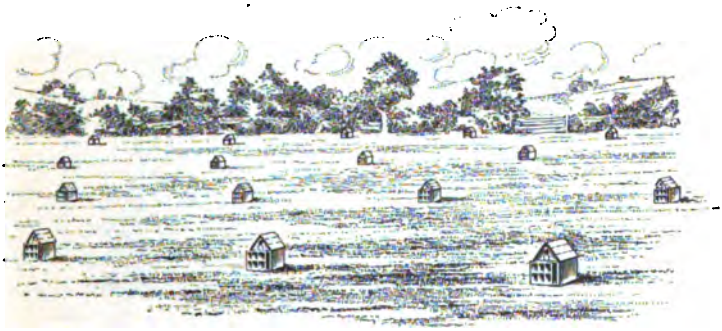

FIG. 7

shown in Fig. 7. A range for 2,000 chicks requires about 7 acres. The coops should have board floors covered with dirt. The chicks begin life with the mother hen in these homes and continue to occupy them until mature. Roost poles are not required in these coops, for the growing chicks can very well rest at night on the floor of the coop. As the chicks mature, the inferior cockerels and pullets are culled out and sold and, by thus reducing the total number of chicks, additional space is gained for the pullets that are left. Large numbers of chicks may be safely grown by the use of these coops in localities that are free from hawks and other animals that prey on poultry, but where such enemies abound profitable use of this system is prevented.

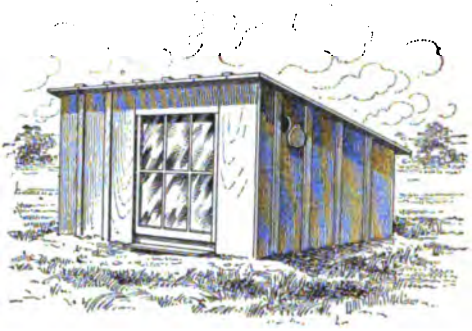

Fig. 8

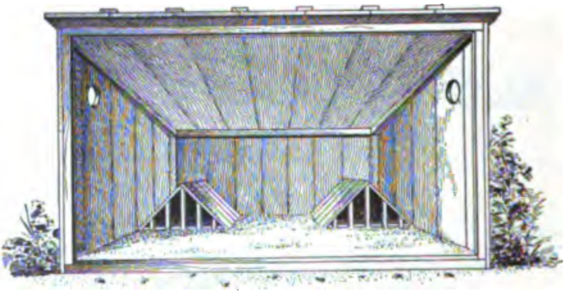

Fig. 9

6. **Double Brood Coop.**—Brood coops of large size, like the **double brood coop** shown in Fig. 8, may be used during

the early spring and fall for growing large numbers of chicks with hens. The coop shown is 6 feet long, 4 feet wide, 3½ feet high in front, and 2½ feet high in the rear. The board floor is strewn with sand and chaff, the window slides to the left, and round openings for ventilation are made on both sides of the coop. Two or three hens or their broods may spend the entire winter in coops like these. The interior of the coop, which is shown in Fig. 9, is fitted with individual brood coops, so that when the chicks are young and the weather is cold, the mother hens can be fastened in these small coops, while the chicks can run about the floor of the large one. The small coops retain the body heat of the hen and chicks and serve to keep the hen under close control; moreover, the mother hen, if confined, will hover the chicks more frequently during the daytime than she would if she had her liberty. As the chicks become larger, the small coops are removed, but the hen should continue to stay in the large coop until she refuses to brood the chicks. When weaning time arrives, the hen is turned into the laying pens and the chicks are allowed to remain in the coops until they are ready for market.

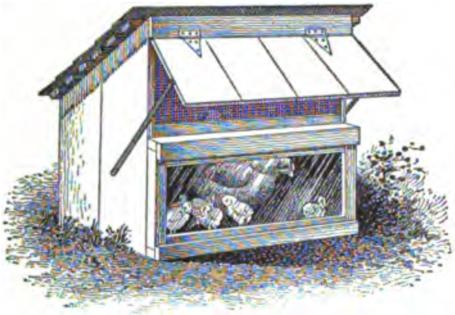

Fig. 10

7. **Coops With Glass Fronts.**—For protection from animals of all kinds, the chicks may be sheltered in coops that have glass and wire-screen fronts, as shown in Fig. 10. These coops are 2 feet square and 2 feet high in front; the glass window is made to slide, and the coop is ventilated through

netting under the hood that shelters the front of the coop from sun and rain. These coops have board floors and shingle roofs, and they are made of 1-inch lumber dressed on both sides. Coops of this kind may be located in lots that are enclosed with wire fence, as shown in Fig. 11.

The coops shown in Fig. 12 are 30 inches wide, 33 inches deep, 3 feet high in front, and 21 inches high in the rear. The frame, except the sills, which are 2 inches square, is made of strips 1 in. × 2 in., and the siding, of lumber ½ or ⅞ inch thick, is fastened to the frame. The siding extends 1½ inches below the bottom of the frame. A movable floor made of 1-inch lumber fits into the opening. The floor rests on the two sills and the roof is made of ½-inch lumber covered with roofing felt. The open space under the sun shelter is covered with wire cloth. The glass sash is made to slide so that the chicks may go in and out between the slats. When the window is removed, the hen is given her freedom.

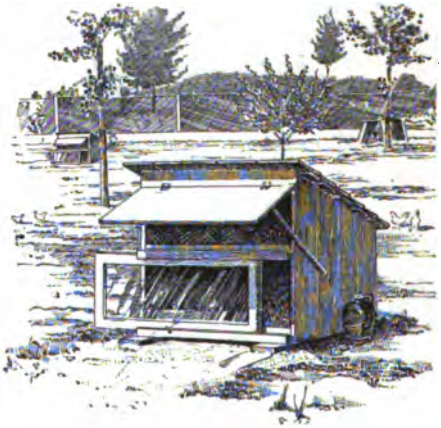

FIG. 11

8. Location and Care of Coops.—As protection from wind, rain, and sun is necessary, it is important that the brood coop, whenever it is possible to do so, should be located near a wood lot, or under trees as shown in Fig. 12. Watch

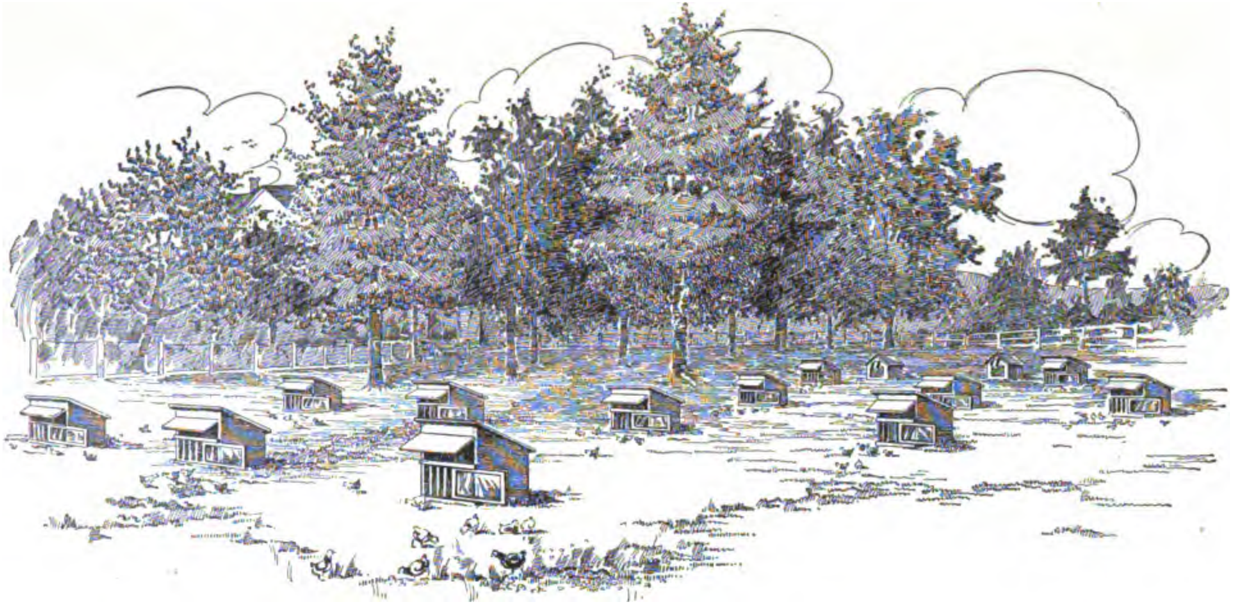

FIG. 12

dogs are often very useful in protecting the chicks, and kennels *a* for them are shown in the figure.

Only coops that are clean and free from dampness and insect vermin are fit for the mother hen and chicks; if any of these pests are present, success in raising poultry is out of the question. Though the coops may be crude and rough in construction, if they are clean, dry, and free from insect vermin, they make good homes for the hen and her chicks; but if the coops are dirty or infested by lice, they serve as death traps for the poultry. No matter how perfect the coops may be in construction, if they are damp or unclean, failure with them is inevitable. All brood coops should be painted inside and outside with crude petroleum or creosote or kerosene or some other liquid insecticide; and the paint should be applied at least a week before the coop is occupied. Of the three insecticides named, creosote, which may be obtained in paint stores, is best. Brood coops should be sprayed inside and outside every 2 weeks with an insecticide of some kind, the work being done in the morning when the hen and chicks are ranging, in order to avoid injury to the chicks by the fumes of the liquid used. The floor of the brood coop must be cleaned frequently to avoid the accumulation of droppings and other filth; because odors that are injurious to both hen and chicks arise from such accumulations.

SHELTERS

9. Colony Shed.—A **shelter** that is useful for many purposes is shown in Fig. 13. This shed may be 6 or 8 feet long, 4 feet high in front, 3 feet high in the rear, and 4 feet wide, and may be used as a roosting place for the growing chicks on the range. Roosts for the growing chicks are placed crosswise inside the shed close to the ground and away from the open end. The ground serves as a floor, and the shed may be moved whenever necessary. The shed is so placed that the opening is not exposed to the prevailing winds. The opening may, of course, be closed.

An **enclosed colony shelter** large enough for several hens and their broods is shown in Fig. 14. This shelter serves as a brood coop for the hens and their partly grown chicks, and may be used as a roosting place for the chicks after they are weaned. This shelter has no floor and is 4 feet long, 3 feet deep, and 2 feet high in front, and, like the shelter shown in Fig. 13, may be readily moved from place to place. Both shelters may be coated with creosote stain or wood preserver as a safeguard against insect vermin.

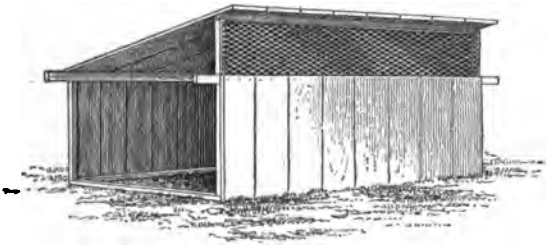

Fig. 13

10. Portable Shelter.—For locations where continuous protection from the weather is demanded, a **portable shelter,** as shown in Fig. 15, is useful. These shelters should be placed with their rear against a fence, and should face the south during the winter and early spring. During the summer there is no better place for them than under trees where they will be sheltered from the sun. They may be made of any size; the one shown in the figure is 8 feet long, 3 feet wide, 30 inches high in front, and 20 inches high in the rear. The entire coop, including the floor, is of tongued-and-grooved

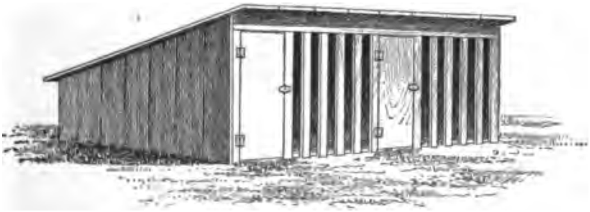

Fig. 14

floor boards; the board floor may, however, be omitted when the ground is perfectly dry. The front is divided into three sections enclosed with wire screen, and the center section may slide to the right or to the left as preferred, thus serving

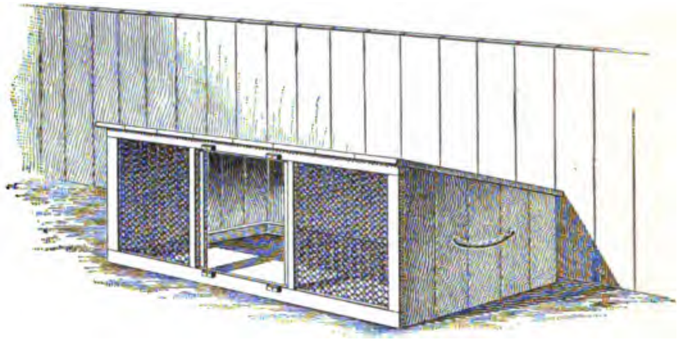

FIG. 15

as a door during the winter months. The whole front may be enclosed with muslin curtains. Brood coops with mother hens and chicks may be placed inside of these shelters where the chicks are safe from all intrusion. The front of the shelter is made of close-mesh galvanized cloth of good strength.

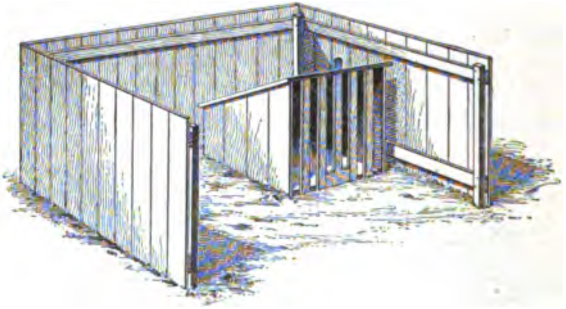

FIG. 16

Another type of movable shelter is shown in Fig. 16. Shelters may also be made of poles and straw; these shelters should be placed firmly in the ground in order to withstand the heaviest storm.

MANAGEMENT OF THE BROODS

EARLY MANAGEMENT

CARE

11. Early Care of the Chicks.—When the chicks are 2 days old they are moved with the hen to the brood coop. Until they reach this age, they should remain in the nest with the hen. The chicks require no food while in the nest, but the mother hen must be given wholesome food daily. The floor of the brood coop into which the chicks are to be placed, should be covered with dry earth or sand with a little chaff on top of it. Chilling the chicks when moving them should be guarded against, and the head and throat of each chick should be carefully examined for any lice that may be hidden in the down. If lice are present, sweet oil or lard is rubbed into the down on top of the chick's head and under its beak and throat. This rubbing is done with the finger and not too much oil or lard should be used. The grease will spread over the skin and will destroy the lice. Finely powdered anise seed dusted into the feathers of the hen and the down of the chicks will also destroy parasites of all kind without injuring the chicks. This powder must be as fine as dust and very dry. Insect powders that irritate the eyes may prevent the chick from eating; very mild powder is the only kind fit for use about a hen with young chicks.

Since a mother hen of quiet disposition will brood and care for her chicks, it is best, especially if the weather is cool, to prevent the chicks from going outside the coop for a day or two. If the weather is warm, the chicks may be permitted to run in the sunshine. A good attendant refrains as far as possible from disturbing the hen and chicks, for if they are frequently disturbed, the hen becomes irritable and nervous and steps on the chicks. The attendant should aim to provide for the needs of the hen and chicks and not to disturb them by handling and coddling them, or otherwise to interfere with the duties of the mother hen. The hen and brood do best if they are undisturbed by unnecessary attention, although regularity in coop cleaning and in feeding must be the rule. The hen and chicks should be taught to enjoy rather than to fear the presence of the caretaker. Chicks that cluster about the attendant usually grow fast and prosper, but those that are neglected or fed at irregular intervals become wild and seldom if ever grow as they should. The water supply must never be allowed to run out; the need for it is nearly constant. If it is neglected, and the chicks are thirsty when it becomes exhausted, they are apt to gorge themselves with the next supply. Should they do so, purging or diarrhea follows and the chicks are almost certain to make no progress for several days, and if diarrhea is induced again, death frequently follows.

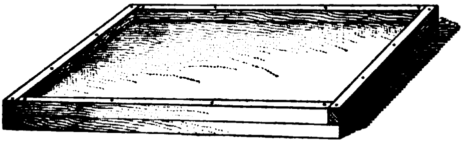

FIG. 17

12. Care of Mother Hen.—The strain necessary for sitting, hatching the eggs, and rearing a brood of chicks will greatly reduce the vitality of the hen; she must therefore be well fed and cared for. The hen will often deny herself food in an earnest effort to induce the chicks to eat. If she does this she should be fed special food that is too coarse for the chicks to eat. She should also be frequently dusted with insect powder to prevent her and the chicks from being troubled with lice. Powdered pyrethrum, or Persian insect powder, can be safely used for this purpose. She should be permitted to go to the dust bath as soon as the chicks are large enough to follow her. A place for the dust bath can be dug in the ground close to the coop. Neither the hen nor the chicks ought to be fed from the floor of the coop or from the ground. Clean boards or feed pans should be used for this purpose. Small feed boards with flanges about the edge may be made as shown in Fig. 17. Safety feed dishes of iron, which prevent the chicks from walking in the feed, are shown in Fig. 18.

13. Location for Brood Coops.—During the season of wind storms, rain, and cold, the brood coops should be placed under shelter that will protect the chicks from direct contact with the elements. In pleasant weather, the coops should be out in the open, where they may be placed on *bare* ground that is free from a growth of grass. If the coops are placed thus, the chicks can go from the coop to the grass, but if the coop is in the grass, the chicks cannot help getting wet if they are at liberty while the grass is moist from rain or dew. In hot weather, it is necessary for the coops to be placed under some shelter that protects the hen and chicks from the direct rays of the sun and from injury from heavy showers. The coop must be placed where the flow of surface water is away from it and not into it or under it. The ground about the brood coop should be dry and free from filth. If the ground is covered with fine gravel or coarse sand, it may be freshened by frequently stirring it with a rake. Brood coops should be moved frequently to avoid the dampness that gathers under the floor. The location of coops that have no floor but the ground beneath them, must be frequently changed in order to avoid injury from tainted soil.

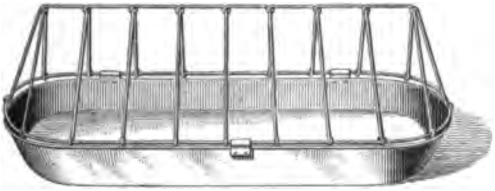

FIG. 18

14. Importance of Keeping the Hens Confined.—If the hen wanders with a brood of young chicks, a considerable number of them are usually lost. Although this practice results in the survival of the fittest, it causes useless waste of living chicks. The chicks thrive best when the hen is kept within the coop and is allowed to run out only for an hour at sunset, not oftener than twice a week, provided that other requirements are fulfilled. The young chicks will run about in the neighborhood of the coop quite as much as is good for them; but if they are compelled to follow the hen they are apt to become worn out in trying to keep pace with her. So long as the mother hen is in the coop, the chicks run out and in at will and are more frequently hovered by the hen than when both hen and chicks are at liberty. Hens that are neglectful of their chicks during the day will hover them when the coop is darkened, so that it is better for them if the coop is so covered that the interior of it is shaded and darkened. Under such conditions the hen will warm the chicks whenever they seek the shelter of her body.

15. Warming the Coop.—A lighted lantern hung inside the brood coop, even if it is a large one, will warm it enough to prevent either the hen or her chicks from being overcome with cold even though the temperature is as much as 20° F. below zero. If the globe of the lantern is painted black or is covered with black cloth the light is so shaded that the hen and chicks will not be disturbed by it during the night. An ordinary lantern used in this way will warm a brood coop of any size not larger than 4 ft. × 6 ft. A lantern may also be used to dry brood coops that are damp inside, or if the coops are dry to remove the danger from outside dampness. Artificial heat, however, should be used only to lessen the danger of extreme cold or damp weather. Good strong chicks that are hatched by hens during cold weather will prosper with the mother hen in tightly built coops even if the temperature should fall below zero.

16. Sheltering of the Run.—Brood coops and runs may be sheltered from the sun during hot days by the use of grain sacks, burlap, or cloth thrown over the run or drawn tightly across it, as shown in Fig. 19. If heavy burlap is tightly drawn it will not only protect the hen and chicks from the sun, but it will also turn the rain. If the sacks for feed or grain are drawn tightly across the run and coated with paint to close the meshes of the cloth, they provide a shelter that will shed the rain and shade the coop for an entire season. In order to have these shelters withstand the rain and wind, they must be well made and firmly set up.

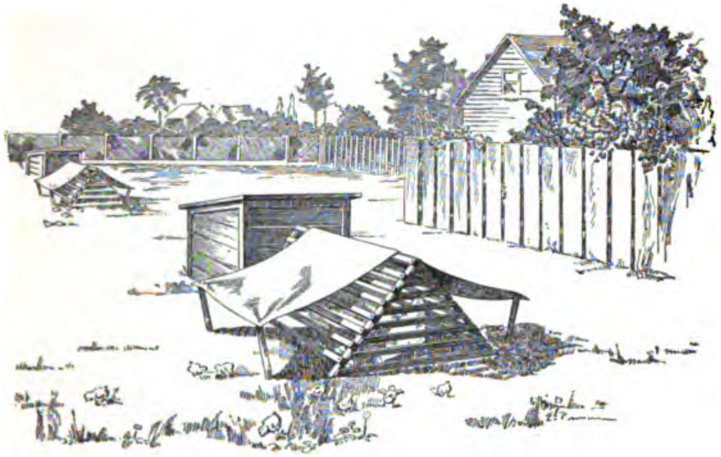

FIG. 19

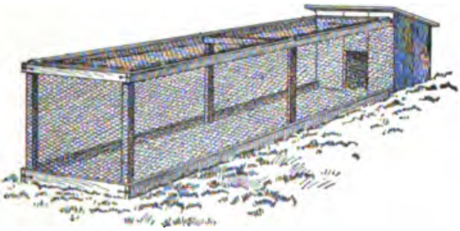

FIG. 20

17. Protection From Cats.—In localities where cats abound, the chicks must be protected from their ravages. The run shown in Fig. 20 not only protects the chicks from cats but also from other enemies, such as hawks and crows.

This run is made 2 feet wide, 2 feet high, and as long as space permits. It is made in sections, two sides, one end, and a top being fastened together with hooks, and the whole run made to fit close to the brood coop. The wire netting has a mesh of ½ inch to prevent the chicks from going out of the run or the cat's paws from entering it. When the run is placed in position the bottom part is sunk into the soil to prevent the chicks from getting out by going under the run. When the chicks have outgrown the danger from their enemies the use of this run may, of course, be dispensed with.

18. Chicks of Odd Color.—Hens that hatch a promiscuous lot of chicks are kindly disposed to chicks of all colors, while hens that hatch chicks of one kind only are apt to kill those that differ in color from their own broods. If chicks of various colors are to be grown, each sitting hen should have the various colors represented in the eggs given to her to hatch; or the chicks may be mixed immediately after they are hatched by distributing them among the hens before they have been taken from the nest. If these precautions are not taken the broods cannot be mixed, as a hen will not usually own a chick different in color from those taken from the nest with her. When chicks are transferred from one hen to another, the change should be made at night while the hens are on the nests, for few hens will accept and care for chicks not their own unless the foregoing precautions are taken.

The young of geese, ducks, turkeys, and guinea fowl may all be hatched and brooded by common hens. If the young of these fowls are hatched in incubators, or by hens other than those that are to do the brooding, the same rules in changing or mixing the broods should be observed as with chicks.

FEEDING

19. Sand or Grit.—No food is needed until after the second day. The first meal, which may be scattered on the feed board, should be coarse, sharp **sand** or fine chick **grit.** This meal is set before the chicks when they are moved with the hen to the brood coop. Two hours later a little—a teaspoonful or less—rolled oats or bread crumbs should be scattered over the grit. This meal should be repeated each hour during the first 3 days. For the last meal at night the chicks may be given all they will eat. After the chicks are 3 days old the method for the feeding of chicks given in *Poultry Feeding*, Part 2, may be followed.

20. **Saving of Food.**—A large saving of grain may be made by feeding the chicks a liberal and plentiful supply in such way that there shall be no waste. Frequently all of any one meal that is uneaten by the chicks or the mother hen is wasted by being trampled under foot and destroyed. All of this loss is avoided by carefully giving each brood just enough food, or by the use of food cups to hold the food for the chicks. The saving by means of food cups and hoppers, however, can be accomplished only when a proper ration is fed.

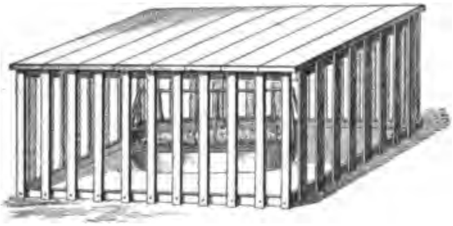

Fig. 21

21. **Use of Food Cups.**—Properly used **food cups** are safe and economical. By the exercise of care and watchfulness, the proper amount of food for a daily ration may be ascertained, and this amount placed in the food cups. Thus the need of each brood is fully supplied, provided there is no intrusion from other fowls. If the broods are fed too much, some of the ration is left in the cup or dish and it is fit for another day. Food cups may be placed under shelter, as shown in Fig. 21. In using cups thus sheltered, the chicks go through the slats into the shelter and feed at will undis-

turbed by older fowls. The use of sheltered cups is not necessary unless a full supply of food cannot be obtained by the younger chicks when they are surrounded by older ones. The water supply for the chicks is placed near the food under the same shelter. Automatic hoppers, which are described in *Poultry Houses*, Part 3, may also be used for the broods.

22. Feeding of the Mother Hen.—The mother hen should be fed three times a day. It is wasteful and expensive to maintain her on the food that is required for the chicks; she should be fed the same as are the laying hens. A food cup fastened to the side of the brood coop, as shown in Fig. 22, makes a convenient place for her food; from this cup the hen will learn to feed herself while the chicks are having their meal of broken grains. If the hen is fed on egg-producing food, she may begin laying while brooding her chicks. If she is confined to the coop she will continue to lay and hover the chicks, but if she is permitted to do so she will leave the chicks and go to the hen house when she begins to lay.

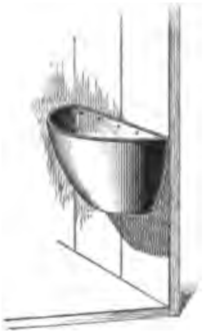

FIG. 22

23. Cold Weather Feeding.—During the winter or early spring, the chicks may be fed by artificial light before daylight and after dark. A lantern furnishes sufficient light for the purpose, and the hen and chicks quickly learn to feed by its illumination. The first meal should be fed in this way shortly before daylight in the morning and the last meal at 9 or 10 o'clock at night. Food that is somewhat stimulating is demanded when the weather is cold. A drink of milk warm from the cow is beneficial for the early morning drink, and lean meat cooked and cut into very fine pieces should be given at noon; rich johnny cake may also be fed twice during the day. If the weather is mild, less stimulating food is preferred.

24. Amount of Food for Chicks.—Chicks should be fed just as much as they will eat up in a short period; more than this quantity should not be fed, as the excess food is liable to become sour or filthy and unfit for the chicks to eat. Chicks that run at will hardly ever eat too much, but it is economical to ascertain how much they will eat and to give them just that quantity, with none to waste. Usually too much food is given to the hen and the chicks during the first 2 weeks, and less than they need thereafter. This error should be avoided, for the chick needs all that it will eat daily until it is fully matured; a smaller quantity than this stunts its growth and retards its maturity.

25. **Drink for Chicks.**—The chicks with the mother hen should be permitted to drink whenever they want to do so, hence water must be always within their reach. Milk is an excellent drink for chicks if it is properly handled; otherwise it will endanger their health. If the ground about them or their down or feathers are smeared with milk, they become breeding beds for disease germs. If milk is given to the chicks as shown in Fig. 23, in vessels specially made for the purpose, it can be taken by the chicks with very little danger of ill effects. The top of a drinking vessel should be movable so that it may be taken off for cleaning. Nothing is more dangerous to chicks than drinking vessels that have an accumulation of filth in them or near them. The vessels used for milk especially must be frequently cleaned; otherwise they become dangerous to the health of the flock.

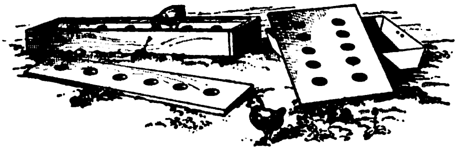

FIG. 23

26. The fact that the young of birds remain in the nest until they are 4 weeks old without moisture other than that contained in the food, favors the opinion that chicks can also be grown satisfactorily until they are 4 or 5 weeks old without drink, and there is some reason for believ-

ing that there is less sickness and bowel trouble when no drink is taken during this time. If *absolutely no drink is given* them from the time they are hatched until they are 4 or 5 weeks old, the chicks do not crave it, but if drink is once given to them the practice must be continued or the chicks will suffer. Broods of chicks that are grown out in the fields may not require moisture other than what they obtain from the rainfall or dew. On the whole, however, the most satisfactory results for poultry of all kinds are secured through the constant use of drink.

27. Mistakes in Feeding.—Failure inevitably follows neglect or errors made in feeding. The giving of too much or too little food are common irregularities. If an excess of soft food or hard-boiled eggs or other concentrated food is given to the chicks, injury will follow. The supply of green food should be regular and sufficient in amount to satisfy the wants of the chicks, and the small or broken grain part of the ration should not be set aside for mash or concentrated feed. A limited portion of the ration is naturally concentrated products, but these should be sparingly used. Animal and vegetable foods must be liberally fed, yet by the excessive use of these foods it is possible to destroy the chick; this destruction is especially likely to happen if nothing but rich, concentrated food, such as hard-boiled eggs, corn meal, oatmeal, and meat, is used. Success in feeding calls for a balanced ration made up of several foods, and not for one made of a single food.

CHICKS ABOUT THE HOME

28. No grown fowls or their young should have the freedom of the dooryard; they should be kept within bounds and should be prevented from becoming a trouble or a nuisance. If the chicks are allowed to overrun the entire place, much confusion and annoyance will be caused. A few hens with their young may, however, be securely fenced in at a reasonable distance from the house if the coops are kept in a sanitary condition. Only a reasonable number can be nicely kept about a town or village home; a few may be a source of pleasure, but a large number kept on a small lot may be both troublesome and expensive.

29. Control of the Wanderings of the Chicks.—Besides being necessary to protect the chicks from cats and vermin, brood coops and runways are necessary to control the wanderings of the chicks and to restrain them from depredations. Suitable coops for these purposes are shown in Figs. 2, 3, 4, and 20, and these coops are specially well fitted for town and city locations where freedom of range cannot be permitted. These same coops and runs may be used to control the chicks until they reach maturity; afterwards, they can be used for fattening pens or for breeding yards for a few fowls.

30. Care of Chickens on Small Lots.—To care properly for a few fowls or chicks on a small lot is a simple matter, but to care for a large number under like conditions is much more difficult. The authorities on poultry growing generally hold that an acre is scarcely sufficient space for 200 hens, yet as many as 100 are often crowded into the rear half of a lot an eighth of an acre in extent. A space sufficient for properly yarding a dozen fowls is frequently used for eight times that number. This excessive crowding is contrary to the laws of sanitation and health. The advantages hoped for in keeping hens in this way are fresh eggs and a few fowls for the table; but while these advantages may be realized from keeping twelve or fifteen hens on such a small lot, success is hardly possible where an effort is made to keep fifty or sixty on the same limited space. Chicks so confined fail to mature as they should; they do not grow to full size, nor do they become the good, marketable fowls that are grown on less confined space. Poultry cannot do well or return an equivalent for care and expense when hampered for space.

31. Feeding Chicks on Limited Space.—The chicks that are kept in limited quarters cannot digest and assimilate their food as chicks do on free range. The range-grown chick has a rugged constitution, such as can be built up only by days of constant tramping or running over an expanse of country in search of food. If they are closely confined, chicks are lacking in vigor and they cannot grind up and assimilate the quantity of rough material that they do on open range. All the food fed to chicks that are kept on limited space should be easily digestible and as free as possible from husk and dry matter. Neither whole oats, barley in husk, nor buckwheat should be fed to young chicks confined to limited space, for no good results come from the use of these grains under such conditions. Hulled oats, oatmeal, and barley without the husk are suitable foods for use in confined quarters. Chicks confined to a limited space do best if fed both wet and dry mash. All grain given to them should be cracked or broken and should be free of hulls. A liberal amount of lean-meat scraps of the best quality is a satisfactory substitute for insects and bugs. It is absolutely necessary that confined chicks have all the green food that they will eat.

32. Fresh Brooding Places.—Remarkably successful results are frequently realized from the first broods grown on **fresh brooding places.** Results obtained on ground freshened by cultivation always surpass those obtained on the same ground before cultivation, a fact that emphasizes the necessity of having fresh brooding places for the chicks each year. Ground continually ranged over year after year by the growing chicks becomes stale and tainted, and this condition must be removed by cultivation. The germs of disease grow quickly in tainted soil, and when these are established, it is only cultivation that can remove or destroy them. Gape worms may prevail in one locality and not be found 100 feet away. The danger from germs is slight on fresh brooding places. An accumulation of filth of any kind about brooding places is detrimental to the welfare of the chicks, and bad results are unavoidable under such conditions. The environment must be such as to assure health.

WEANING THE CHICKS

33. Weaning Age.—When she is permitted to do so, the mother hen **weans the chicks** when they are from 6 to 8 weeks of age, although some hens are ready to leave the chicks when they are 4 or 5 weeks old, and a few other hens will continue to mother their chicks until they are 12 weeks old. If she is confined to the brood coop and not permitted to wander, the hen may be kept with the chicks until their covering of feathers is complete. The chicks should not be weaned until they are sufficiently grown to care for themselves and to be warm at night. Up to the first of June they do well if they are kept with the hen until they are 10 or 12 weeks old; from June to October they are usually fit to wean at the age of 8 weeks; and if they are unusually well grown, they can care for themselves at a younger age. Regardless of age, the chicks should remain with the hen until they are fit to care for themselves, this fitness depending on size and a sufficiency of feathers to keep the chicks warm at night.

34. Control of Weaning.—As long as the mother hen is confined to the brood coop, she will usually continue to brood the chicks, and in this way they are kept warm at night. For this reason, the hen should be confined and the chicks be permitted to go about. If the hen has her freedom, she is apt to quit the brood without warning, and her work in keeping the chicks warm at night ceases abruptly and the progress of the chicks is seriously retarded. The critical period in the life of the chick begins as soon as it is weaned. The change from having the body warmth of the mother hen to not having it may occur during a damp, cold spell; in that case warmth must be furnished or the chick will suffer. For these reasons, it is best to control the weaning time, and keep the hen on duty as long as she is needed by the chicks.

35. Feed at Weaning Time.—When the mother hen leaves the chicks they lose the natural warmth of her body. To make up for this loss, more fat-forming food is required. By feeding this kind of food, the bodies of the chicks are warmed and they continue to grow. Light feeding at weaning time retards the growth and weakens the constitution. More lasting harm comes from lack of food at weaning time than from a scarcity at any other period. Not only does the chick need an additional food supply when weaned, but also when a change to cold weather occurs, and as the fall and winter seasons approach. The food requirements of the weanling, which are the same as those of the chick at the age of 12 weeks, are indicated in *Poultry Feeding*, Part 2.

36. Care at Weaning Time.—If the weather and other conditions are favorable, no special care of the chicks at weaning time is needed; but if the weather is cold and damp, reasonable warmth and protection from dampness are required. A suitable coop for weaned chicks is shown in Fig. 24. This coop may be 6 or 8 feet long, 4 feet wide, and 4 feet high in front. One or more roost poles should be placed lengthwise across the rear of the coop. The large open space in front must be closed with wire cloth or poultry netting, which protects the chicks at night and admits an ample air supply. When the chicks are on the roost at night and the door is closed, they are well protected from severe weather and from any destroying animals.

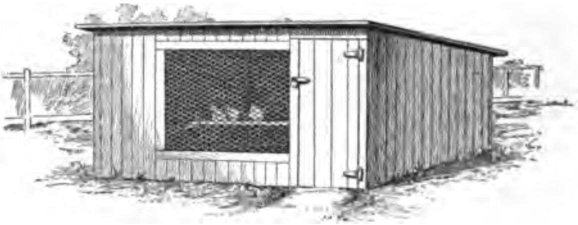

FIG. 24

37. Roosting Places.—Roosting is a habit quickly acquired by the chick and the example of a hen or two kept with them soon teaches them to use the **roosting places.** Trees furnish a good roosting place during the summer months, but if the habit of roosting in trees is acquired by fowls when they are young, it is difficult to break them from it. The uncertainty as to the whereabouts of the chicks that roost in trees is the main objection to the formation of this habit. Chicks of the smaller breeds begin to roost at ages ranging from 7 to 10 weeks, but those of heavier weight should not be permitted to roost until they are fairly well grown. The breast bone of chicks becomes crooked or bent if they roost at an immature age on narrow roosts, therefore roosts for growing chicks should be made 3 or 4 inches wide on top.

38. Danger From Crowding.—When weaned chicks roost together in large numbers, especially in small coops, the chicks are apt to crowd close upon one another and some of them may be smothered. If the roosts are all on one level, however, there is little, if any, danger of crowding. Fresh air is a necessity for chicks, and if the inside of the coop is overheated at night, the chicks may smother for want of air. Close or confined coops are to be avoided during warm weather; those with open fronts covered with wire netting are better for hot nights; even these fronts cannot be too open for sultry nights, but if the nights are cool, the opening should be *partly* covered with curtains. If the temperature is normal and no chill passes over the chicks, there is less danger of crowding than when drafts are present in the coop.

MANAGEMENT AFTER WEANING

THE FEEDING OF RANGE-GROWN CHICKS

39. The outdoor life of the **range-grown chicks** makes them more vigorous than those that mature in places sheltered from all danger. The food given to the range chickens must, however, be of a kind that builds up a rugged constitution. Chicks that are grown in this way and in large numbers learn self-protection from association with the mother hen,

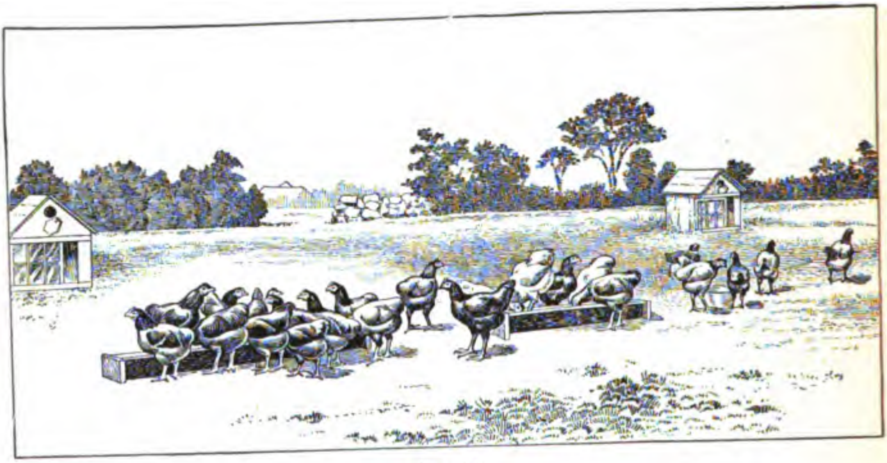

FIG. 25

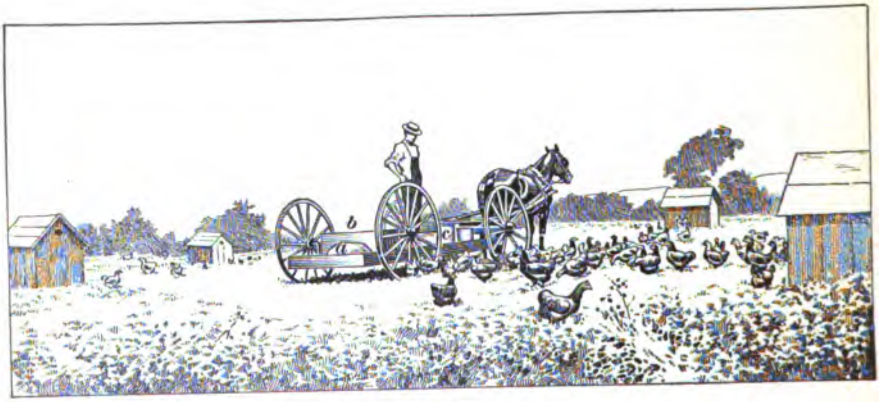

FIG. 26

and they have more vitality than is usual with those grown under restraint.

After they are weaned, the range chicks should be fed twice daily, once in the morning and once at noon, at feeding stations that are scattered over the fields. Morning and noon both mash feed and grain should be given to chicks in troughs like those shown in Fig. 25. Sufficient food must be given each colony fully to satisfy its wants. The noon meal is the heavier, as the supply then given must furnish all the chicks need for the rest of the day and a little left over for the early morning meal. Two feed troughs and a large drinking vessel are required for each feeding place. The drinking vessel should be constantly full of water. The mash feed is placed in one trough and the grain in the other, and the quantity of each ration needed must be learned by closely observing the chickens each time they are fed. The water and food supply may be carried to them in a wagon, from which the feed can be shoveled into the troughs. The wagon used is best if set low as shown in Fig. 26; in the rear of the wagon are the bags of grain *a*, and in front of these a large feed box *b* for the wet mash. In the front part of the wagon are water cans *c* in which the water is taken about. By the use of a wagon a full supply of food for 4,000 chicks can be carried in one load to the various feeding places and distributed.

40. Manner of Feeding the Colonies.—The mash for the morning meal can be cooked at night and left in the kettle to cool. The mash is made of bran and cracked corn in equal parts, the corn being cooked or boiled until soft, and the bran mixed in after the corn is cooked. To this mixture is added 10 per cent. of its bulk each of corn meal and beef scrap. A small amount of ground shell and bone, not more than 1 quart to 4 bushels of meal, is also mixed into the mash. The mash that is to be fed at noon should be prepared in the morning as soon as the kettle is empty. The grain ration is made up of whole corn, cracked corn, oats, and wheat. Of the entire ration for the growing chick upon the range, 50 per cent. can be corn. The meat scrap fed in the mash together with the bugs and worms picked up by the chicks will fully counteract the fattening influences of this grain ration. A small portion of ground linseed meal, about 1 pint to 1 bushel of the mash, can be mixed in it daily. The mash is shoveled from the cooker into the feed box *b*, the grain is placed in sacks, and the feeding of 4,000 chicks is completed in an hour. As the wagon passes each feed station, the troughs are filled and the water vessels replenished.

The colony coops are arranged in lines and the oldest chicks are housed and fed in the first row of coops; and those next in age are placed in the next row, and so on, until the last hatched, or youngest, chicks are housed in the last line. The small chicks are fed a ration that consists of finely cracked corn, cracked wheat, and hulled oats. The larger chicks soon become accustomed to their own feeding stations and seldom intrude on the others. This habit is the result of liberal feeding; for, as the chicks are well supplied at all times with food, there is little to entice them away from their own station in search of food. When the chicks are trained to a regular feeding hour at a given place, they will be on hand to be fed at that time, and nothing but neglect or irregularity will change this habit.

41. Quantity of Food Required.—To satisfy a flock of 3,000 chicks growing on the range calls for at least 20 bushels of feed per day, or about 6 ounces, or a little more per day to each chick. One-half of this quantity should be mash and the rest of it grain. Fed in this way, the chicks grow quickly and are ready for marketing at ages ranging from 4 to 6 months. The chicks occupy the coops as a roosting place until sold or fully matured; they sit on the floor of the coop at night, not on roosts, with the advantage that the breast bones of the chicks are neither bent nor broken down, constituting a material gain in their market value.

IMPROVEMENT OF THE FLOCK BY SELECTION

42. Selection of the Culls.—The value of the flock both for egg production and for market use may be greatly increased by careful culling, or the picking out of inferior individuals, as the flock matures. The improvement resulting from this practice will be more and more manifest each year, provided the most desirable individuals are reserved for breeding purposes. If the best of the flock are sold or killed each year, only the culls remain, and no future improvement can come from inferior breeding stock. The excellence of the chicks produced each year depends on that of the hens that produce the eggs from which the chicks are hatched. The eggs being the source from which the future chicks must come, their quality of necessity will be influenced by the quality of the hens that produce the eggs; if these hens are poor egg producers or lack the characteristics that mark the best grades of market poultry, the same characteristics will appear in their chicks. The best of all the chicks grown each year should be selected for the egg producers of the coming season; the inferior chicks may be sent to market or used for the table.

To prevent overcrowding and to avoid a useless expenditure of food, the flocks should be culled as they grow. When the chicks have reached a salable size, those least desirable should be sold; if the most desirable are sold, the best of the flock is gone and its value decreased. If only the culls are sold the value of the flock is greatly improved. This culling should be continued throughout the entire season until the flock is reduced to the desired size. All cockerels in excess of a reasonable number reserved for breeding purposes should be sold as soon as they are ready for market. In this way the size of the flocks can be kept within reasonable limits and their accommodations not overcrowded. The future improvement of the flock depends largely on the careful culling of the chicks as they grow. The process of culling may be compared to the skimming of milk, the cream of course being represented by the choice specimens left after the inferior ones have been disposed of.

43. Type of Birds to Keep.—The cockerels and the pullets that grow quickly into birds that have plump, graceful forms are usually the most promising for future egg production. The birds that have long legs, slim necks, and ill-proportioned bodies should be sent to the shambles. To produce eggs there must be prominence of crop and breast, indicating high food-consuming power, and liberal development of body and abdomen to provide space in which the eggs may be formed. Legs that are long and badly shaped indicate that the fowls possessing them are poor egg producers and such limbs are objectionable in market poultry. Birds that have heads that are rough or coarse in formation, or necks that are unduly long or slim, or heads with unsymmetrical or unshapely combs, should be ruthlessly eliminated from the flock.

Female chickens with normally developed breast and abdomen, evenly poised fore and aft upon legs of a length that conform to the size and shape of the body, usually develop into good egg-producing pullets, and this same type of birds produces the best table poultry.

44. Selection of Culls for Market.—As the chicks develop, those that are intended for market should be sold as soon as the opportunity to do so occurs after they have attained marketable size. By proceeding in this way, the stock will gradually be reduced and the necessity of dividing the flocks be obviated. Chicks that grow and mature quickly are usually ready for market at any time without a special period of fattening. If they are not properly grown, they are seldom, if ever, fit for market under the age of 7 months. The selecting for market should be done with the prime object of keeping the best individuals and of selling those that are not needed for renewing the stock. The more carefully this selection is made, the more desirable will be the individuals retained. When selling poultry, always dispose of those of least value in the flock; if this plan is faithfully followed for a few years, the value of the flock will be more than doubled. To profit by selection, the work must be carefully done year after year without cessation; no deviation or departure from this rule can be indulged in or the good results already gained will be lost. If the best poultry is sold each year, the strength and vitality of the flock will soon be gone, and both egg production and marketable value will be impaired beyond remedy.

45. Feeding of Culls for Quick Maturity.—In order quickly to prepare them for market, the surplus cockerels and as many of the young pullets as seem suited for market poultry only, can be separated from the main flock and kept in confined quarters. The less exercise they have the more quickly do they mature into marketable condition. When kept in close quarters and fed for market, they gain in weight but lose strength; so that they are apt to get weak, or "go down," if heavily fed for any length of time. To avoid this condition, they should be sold as soon as they are plump and fat. Feeding them for the market improves the quality of the meat and makes it more desirable for table use. All fowls used for food should be fed into a plump condition before they are killed; if they are thin in flesh there is a large per cent. of bone and offal, whereas if they are plump and fat, the per cent. of waste is less, the meat is more palatable, and in general the value of the carcass advances as the quality is improved. A young fowl that is thin in flesh may weigh 3 pounds, of which 2 pounds may be waste products; if the fowl be fed to weigh 4½ pounds, there is the same amount of waste, but the increase in weight is made up wholly of edible meat, and the amount of this is almost treble what it was before the chicken had been fed into plump condition.

DISPOSAL OF THE CULLS AND SURPLUS COCKERELS

46. Time of Selling.—When the young stock is grown for market it should be sold as soon as it is in proper condition. If the birds are grown for broilers, they should be sold at broiler size; if for roasters or intermediate sizes, they should be sold when properly grown. Like fruits, young fowls sell best when they are fit for market; at no other time do they bring the price they command when they are young, plump, and fat. It is best in almost all cases to sell the surplus fowls rather than to house them in the fall. The expense of housing and feeding non-productive stock beyond the time they are fit for market, may equal or exceed the price received for them when sold.

47. Feeding of the Birds Before Selling.—The plan of **feeding for quick maturity** should be closely followed in feeding the young stock a few weeks before it is sold. The better the birds are, the higher the price they will bring; for the highest quality is sought after and always commands a profitable price. All poultry that is to be sent to the market should be yarded for at least 2 weeks prior to being sold, and should be fed into prime condition. Full particulars as to this kind of feeding are given in *Market Poultry.*

48. Sending the Birds to Market.—Appearance has the controlling influence in the most desirable markets; for this reason, every grower of poultry should learn to dry-pick, truss, and pack his birds for sale, in the most approved manner. All of these items are considered in *Market Poultry.* If the chickens are sent to market alive, they should be packed in shipping coops sufficiently large to carry them to destination without crowding. Chicks of different sizes or ages should not be shipped together in the same coop, nor should the males be sent with the females. Chickens of uniform size sell more readily and bring better prices than those of different sizes. The same rule applies to the shipping of dressed poultry; only birds of one size, shape, and color should be packed together. If the weather and distance permit, the dressed poultry that is sent dry, without ice, will arrive in the most salable condition. The danger of spoiling in transit must determine the method of packing; it is better to pack with ice than to have them spoil in transit. Consignments made up of attractive shipping cases in which the contents are well packed always sell at a great advantage over poorly made shipments.

49. Selection of Customers.—When distance permits, individual customers that require poultry each week are much to be desired. For customers such as these, as in fact for all customers, the products offered should be honestly packed and described. If the quality of the goods sold is finer than the general stock in the market and if it continues to improve, almost any reasonable price will readily be paid for it. Individual customers are easily retained if the quality of the product is maintained, but they are quickly lost if inferior goods are furnished. This same rule applies to all grades of commission houses; the quality of the product always governs its sale. The good reputation that comes as a reward for quality is worth much to the poultry man. Goods that are marked A1 and the quality of which can be depended on, bring large profits to the shipper, while goods of uncertain quality are equally uncertain in value. No one is deceived by the practice of topping out poor packages with a row of the best on top. Packages of this kind sell at the value of the poorest, no attention being given to the few good individuals. Quality, like water, finds its level; and the best quality is always in active demand.

50. Gradual Disposition.—Small-sized enclosures, or yards, each of which contains a house and a few feeding coops, are useful to those who raise poultry for the market or for table use. A few chickens may be selected each week and placed in the yard; as these improve under an approved system of feeding for market, the best of them are selected each week and placed in the feeding coops to be fattened for market. By following this system week after week, all the surplus stock may be disposed of at the most advantageous prices, and in this way the full value is received and a profit made. As has been said, all poultry intended for market should be generously fed on fattening foods for at least 2 weeks prior to being sold. Well-prepared warm mash feed does well for this purpose. A well-balanced ration produces the most palatable table meat; the fattening ration produces most weight. Poultry is greatly improved as table meat if fed, for 2 or 3 weeks prior to killing, with feed that softens the muscles. This same system of feeding breaks down the hardened parts and makes tender all the meat on the fowl.

SELECTION OF PROSPECTIVE LAYERS

51. The outward indications of future egg production in growing pullets are shown in body formation and in general appearance of the individual shown in Fig. 27. The indications are also strongly prominent in head and eye; and while there is no rule of selection that is absolute, the desirable individuals in each flock can be selected if outward indications are carefully observed. The head *a* of a prolific egg-producing Leghorn pullet is rather long as compared with the head *b* of an indifferent producer. The eye of the generous layer is long, very bright, and prominent; the beak is strong

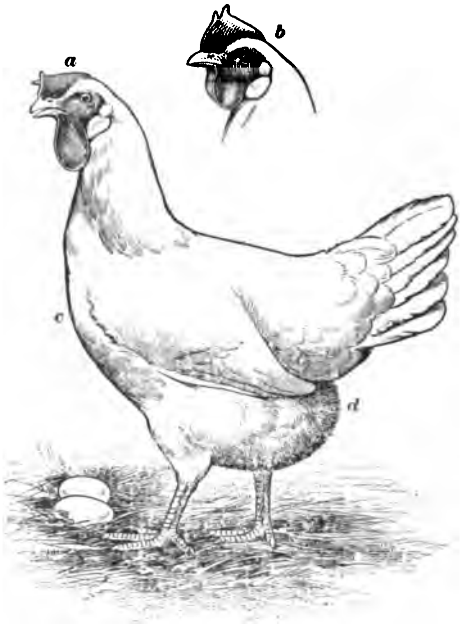

Fig. 27

and nicely curved, and the entire head and neck has a marked appearance of strength and vitality not present in the case of the less thrifty pullet. The body line in the good layer is prominent from the point of the breast *c* to the abdomen *d*; between these two points the food consumed is assimilated and transformed into eggs. There is plenty of room for the continued and effective action of the egg-producing organs.

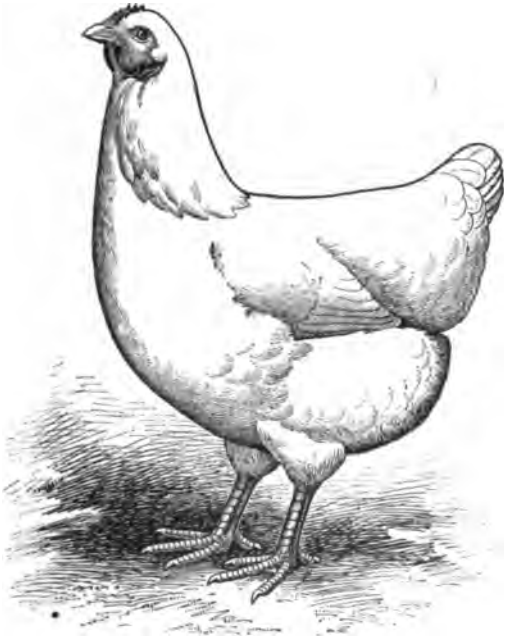

FIG. 28

Width between the thighs permits a widening of all the organs of the body, while narrowness in that region contracts the abdominal cavity and so prevents the best action of the egg-producing organs.

52. **Advance Signs of Egg Production.**—Pullets that display unusual development of body and abdomen can be selected with full assurance of future prolific egg production. Those that early have well-proportioned bodies and unusual

activity have an innate aptitude for gathering and consuming food enough for a large yield of eggs. The nervous, active pullets that possess well-developed bodies give unmistakable promise of a large yield of eggs. Pullets in which these characteristics are apparent are the most desirable of all the flock, both for the market and for egg production, and they are eagerly sought after by the market huckster. These advance signs are also indications of unusual prolificacy and fertility, and marked improvement comes from the retention of males and females of this character in the flock. If these birds are well nurtured and cared for, their value is assimilated by the flock; if they are destroyed or neglected, their value is lost.

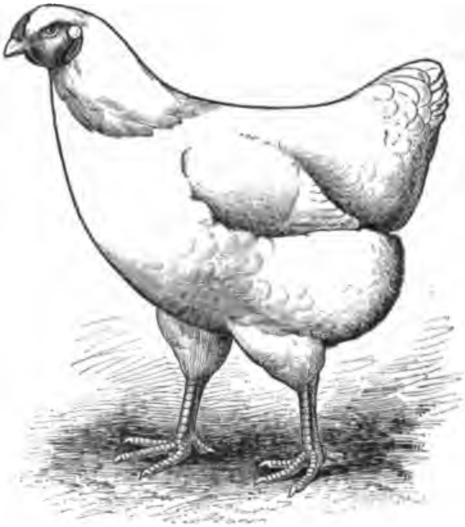

FIG. 29

53. Body Proportions of Laying Pullets.—A well-balanced body poised on legs that are set wide apart and almost half way between the point of the breast and the rear end of the abdomen, gives marked assurance of future ability to produce a large yield of eggs. This is plainly apparent in all good layers of all kinds, the length of body from point to point, the width between the thighs, and the depth from top of back to the lower margin of the breast bone, being as important in the Plymouth Rock, which is shown in Fig. 28, as in the Leghorn. The same conditions are of equal importance in the Wyandotte, which is shown in Fig. 29, and, in general, this rule of proportion governs in all kinds and varieties of fowls. Summing up, it may be said that hens to be good layers must be able to consume, digest, and assimilate sufficient food to sustain the body and to leave a surplus of food elements for eggs; that a high degree of vitality is necessary to endure the continuous drain on the system entailed by continuous egg production; that a body to be well balanced must have length, breadth, and depth enough to accommodate amply all the organs of the body, including the egg-producing organs.

54. Age at Which Pullets Should Be Selected.—Although some pullets are so far advanced at the age of 4 months that they are almost ready to lay, their average development is not sufficient to permit the selection of the most desirable pullets until they reach the ages of from 5 to 6 months. Leghorn laying pullets may be safely selected at the age of 4 months, but those from birds of larger and of slower development may be selected at 6 months. Pullets hatched before the middle of May should lay during the same year, but those hatched after the first of June seldom begin to lay before the following March. The most satisfactory development results from a regular and continuous growth, and if growth is retarded at any time, the loss is seldom regained. Pullets grown under the best conditions are frequently more fully developed at the age of 6 months than are others after a year's growth under less favorable conditions. The beginning of the laying period with a pullet depends entirely on her development, and this development, either good or bad, reveals the kind of care and feeding she has received since she was hatched.

55. Value of Vitality.—By vitality is meant the power of continued endurance, without which the pullet cannot be a prolific egg producer. Pullets that are narrow or contracted in body, breast, and abdomen generally lack in some measure the vitality required to operate the body continuously, and in addition to produce eggs. Too much stress cannot be laid on the value of strong, overflowing vitality in all kinds of poultry, nor can the growing pullet have an excess of it. An alert, buoyant carriage; a light, active step; a quick movement; bright eyes; and a well-proportioned body are all indications of vitality. No specimen that is deficient in vitality should be retained as an egg producer, for by the removal of such specimens, the possibility of their reproducing their kind is gone. If pullets that lack in vitality lay at all, they do so in the spring during hatching time. At this time, their eggs may be gathered and used for hatching, and the only certain method of avoiding this is by discarding these poor specimens early in the season.

PREPARATION OF THE PULLETS FOR WINTER

56. Free Range.—Nothing is better than the freedom of the range for growing pullets, provided they are plentifully fed on the best growing rations. Free range and food of this kind develop the entire body and build up vitality to the highest degree. If the pullets have enough food, no amount of outdoor exercise can keep back their development. But if they wander aimlessly in search of food, and are but sparingly fed with grains of indifferent food value, no growth other than that of long thighs and shanks, angular muscles and tendons is made. No other place equals the fields of the farm for developing the pullets for winter egg production. Under such conditions, they mature most satisfactorily, provided that they are plentifully fed with grain that develops the body and internal organs, and that produces a liberal coat of feathers. A ration made up wholly of corn or of any other one grain will not do this; a ration that induces growth must be fed.

57. Maturing pullets thrive on the open range until cold weather drives them inside. Whether on the farm, the poultry farm, the small poultry plant, or town or city lot, they should run in the open as long as possible, and they should roost in coops, sheds, or houses that are partially open. By roosting in these open shelters, they become accustomed to living in the open, and they will continue to do well the entire winter if kept under similar conditions. If suddenly changed from the open range and woods to close houses, injury may be done the pullets. The winter quarters for them should be well ventilated; otherwise, the inside conditions may be oppressive, and colds will result.

58. Preparation for Egg Production.—The foundation for **prolific egg production** is laid during the growing period of the life of the pullets. During this growth the crop is distended by the heavy feeding of mash and grain, thus establishing a great capacity for food. If the birds are but sparingly fed, their crops remain small and contracted, thus making it impossible for the pullets to store a large food supply for use overnight. When the pullets are plentifully fed on the proper kind of food, all of their internal organs are kept constantly in action, thereby keeping the organs in a healthful condition and of normal size. If action is suspended for lack of sufficient food to keep the organs at work, they do not develop normally and cannot handle sufficient food to sustain the body and to produce eggs. There must be proper and ample preparation made in advance to develop the pullets for egg producers. This development is accomplished by keeping them continuously growing from the time they are hatched until all their functions are fully developed.

59. The pullets selected for winter layers should be fed for body and feather development without being forced for unnaturally early egg production. The food should consist of a strong growing ration, a narrow ration with some fat-forming grain being good for them. When the pullets have unlimited range where worms and bugs abound, corn, oats, and wheat are desirable additions to their feed. If but little animal or insect food is picked up by them, less corn and some meat scrap should be fed. The aim should be to furnish a well-balanced, egg-producing ration in order to develop body, feathers, and egg-producing organs, and the pullets must be fed in this way if the best possible results are to be realized.

60. Time of Changing Quarters.—The longer pullets can stay on the range, the more complete will be their development. If they are left out until the end of October, or later, depending on the climate, the pullets will acquire the vigor required to withstand the strain of winter egg production. The houses into which they go must be thoroughly cleaned and prepared for them; no insect vermin, dampness, or drafts should be possible within the house, but it must be well ventilated. When winter comes in October, the birds can be moved into the house early; but if the weather remains pleasant until December, they can rove about the range until the approach of cold weather. There should be nests in the coops on the range for pullets that begin to lay before moving time.

61. Removal to Winter Quarters.—When removed from their growing quarters into their winter house, the pullets must be provided with all the food elements that they formerly found on the range. An abundance of animal and vegetable food must be given as a substitute for the green food and bugs of the range, and they must also have as good ventilation in the house as they had in the coops. Quiet and gentle handling has a beneficial influence over the pullets at this time. When the egg-producing organs are developing, the nervous system is under a strain; if the birds are roughly handled or frightened at this time, serious physical injury to them may result. Coaxing rather than force should be used with them and they should be induced by gentle means to enter the house at night and to roost in the proper place. If the pullets have been removed from coops that are wholly or partially opened into close or tight houses, the deficiency of air will be injurious to them. The same general conditions should exist in their winter houses as they enjoyed in the coops from which they are taken.

ARTIFICIAL INCUBATION

EGGS FOR INCUBATION

INTRODUCTION

1. During recent years there has been a largely increased amount of market poultry, resulting from the practice of **artificial incubation.** Through the use of incubators, hatching goes on each month, and a livelihood from poultry raising is assured. The time required in caring for a dozen sitting hens more than equals that used in looking after an incubator. The hens must have attention during the day, but incubators can be cared for at night. The incubator operator can control production by artificial means, but with hens a desire to hatch cannot be hastened. The artificial methods of hatching and rearing chickens bring alike to the farmer and to the small grower the choice of the day of production and of the number of chicks produced.

2. Incubation Periods of Various Fowls.—The eggs of hens hatch in 21 days. Those of geese and ducks hatch in 28 days. The eggs of turkeys hatch between the twenty-sixth and the twenty-ninth day, while those of guinea hens hatch in 26 days. There are slight deviations from these periods, eggs from Bantams and other small breeds of fowls often hatching on the nineteenth or twentieth day of incubation, and those of some varieties of geese hatching in 30 days. The eggs of the Muscovy duck hatch in 35 days, but if these ducks are crossed with a Pekin or other kind of drake, the time for hatching is about 32 days. The eggs of pheasants

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hatch in about 24 days, and those of peafowl hatch in from 28 to 30 days. The incubation periods of the several varieties of swans vary from 35 to 40 days. These periods are normally of the same length for both natural and artificial incubation. Fresh-laid eggs from fowls of all kinds hatch in fewer hours than eggs that are kept 2 weeks or longer before the process of incubation begins.

VITALITY OF THE EGGS

3. The results obtained from artificial incubation depend primarily on the **vitality of the eggs;** but the handling of the incubator, surrounding influences, and the general efficiency of the incubator itself are other conditions of fundamental importance. The per cent. of eggs hatched depends on all of these conditions, and unless they are favorable, only poor results can be obtained. When life begins in the egg, there must be sufficient innate force to assure the continuance of the life process to its completion. If the embryo springs from a weak germ, it has a short existence; if it has its beginning in a strong germ and the egg lacks vitality, the embryo cannot continue to grow; if the egg is strong in vitality but improperly incubated, it is impossible to produce living chicks. The union of all desirable conditions is necessary for the best results, and no amount of care or of good management can bring chicks from eggs that lack vitality.

The vitality of eggs depends on the constitutional vigor of the fowls that produce them; superior vigor must come through several generations of strong, healthy fowls. It follows therefore that, in order to have embryo chicks of marked vitality, eggs must be used that come from strong, vigorous, well-bred birds.

4. Vitality does not exist in mongrel flocks that are inbred or badly fed, nor do the best selected hens maintain vitality if they are inbred or badly fed, or are confined in small yards without sufficient exercise. The fowls that produce eggs of strong vitality are grown under natural conditions from vigorous uncrossed stock; they are housed under conditions that increase vitality, and are fed in a way that strengthens the internal organs and prevents the formation of internal fat. Strong, vigorous, active hens mated to males of equal vigor are the kind that produce eggs from which a large per cent. of strong, healthy chicks are hatched.

No amount of food or of good management in feeding will improve the vitality of anemic fowls, nor will any amount of care bring them to a condition sufficiently vigorous for producing eggs of the vitality needed to obtain healthy chicks. The vitality of hens that are kept in small yards does not equal the vitality of those that have free range, but hens that have lost their vitality through being housed all winter will regain it if they are given free range in the spring. No kind of care or feeding in narrow quarters is a satisfactory substitute for partial freedom in large enclosures or the full freedom of the range. Low vitality is improved by proper care and feeding, but full vitality, once it has been lost, can never be regained by feeding.

5. The *per cent. fertility* is an expression that is frequently misleading. More than 90 per cent. of the eggs may be fertile and yet no living chicks may come from them, because the germ is so lacking in vitality that it dies before incubation is completed. The per cent. fertility is increased by proper feeding and the vigor of both male and female is also increased, but there is a pronounced difference between fertility and vitality. The former may exist to a marked degree even though the vitality of the germs or the egg be lacking, but the latter obviously cannot be present without the former. Proper care and feeding is of supreme importance; their constant practice improves the vigor, fertility, vitality, and hatchability of the eggs. Too much importance cannot be attached to care and feeding, but it must always be remembered that the lack of vitality is not overcome by feeding.

6. As the result of unusual care and attention during the time of incubation, weak germs may develop into fully formed chicks. These weaklings may be grown to maturity as the result of perfect brooding and they may be used as market poultry, but such fowls are never fit for breeding stock. The ailments of chicks are traceable to one or more of the following causes, namely, lack of vitality in the breeding stock, improper incubation, and imperfect brooding, care and feeding of the young chicks being included under the term brooding. From one or more of these causes comes the greater portion of all losses.

There is a marked difference between the production of birds for exhibition or for beauty and the production of those fitted for egg yielding and for table meat. Where the exhibition birds are desired, the producing stock must be yarded to avoid the mixing of breeds or varieties. This is necessary only during the breeding season. At other times the old and young stock may have free range. Where egg producers and market poultry are desired, it is best to give the breeding stock all possible liberty. It is best to keep only one variety, and the flock should have free range if possible.

SELECTION AND CARE OF EGGS FOR INCUBATION

7. Selection.—Eggs for hatching in an incubator should all be of one kind, size, and color; under these conditions they hatch more uniformly. Eggs with white shells hatch in fewer hours than do the dark-shelled eggs, for white shells are thinner and transmit heat more freely to the germ within. Under the same conditions, eggs with white shells will have larger air cells than those with heavier shells. If the eggs are of uniform size, the temperatures of all are equal or nearly so; if large and small eggs are in the same machine, the temperature may not be the same in all. Only smooth and well-formed eggs should be used; eggs with uneven surface, bad form, rough shells, or mixed colors should be discarded, as well as eggs that are abnormally large or small. The eggs from Leghorns and Brahmas do not hatch well if both are together in the same incubator, for the eggs of the Leghorns usually hatch during the twentieth day, while the hatching of the Brahma eggs may be delayed to the end of the twenty-first day. If eggs from Leghorns, Plymouth Rocks, Wyandottes, and Brahmas are all together in the one incubator the hatch is irregular. Eggs but 1 day old hatch a day sooner than eggs that are 2 weeks old. Leghorn eggs placed in an incubator on the day they are laid may hatch in 480 hours; but eggs of Asiatic fowls placed in the same incubator when 2 weeks old may not hatch for 516 hours, a difference in time that makes poor results inevitable if the eggs of both breeds are incubated together. The eggs of ducks and of chickens cannot be successfully hatched together in the same incubator, nor do the eggs of any two or more kinds of fowls hatch well if placed together in the same incubator or under the same hen.

8. Care. — Eggs for hatching may be kept in boxes, pans, buckets, or baskets. Specially made egg drawers and cases, like the case shown in Fig. 1, are sometimes used to hold them. Egg cases like those used for shipping eggs to market are also safe storage places for the eggs selected for hatching. Such cases hold 360 eggs each. The eggs are placed in the case small end down, and those reserved for hatching should be changed about at least every other day. This is done by removing the eggs from one receptacle to another or by changing the position of the case or drawer. When shipping cases are used to hold the eggs, in order to change the position of the eggs it is necessary only to tilt the case to one side and to place a block under the other side. This reversal of position should be made each day. Eggs keep best in a

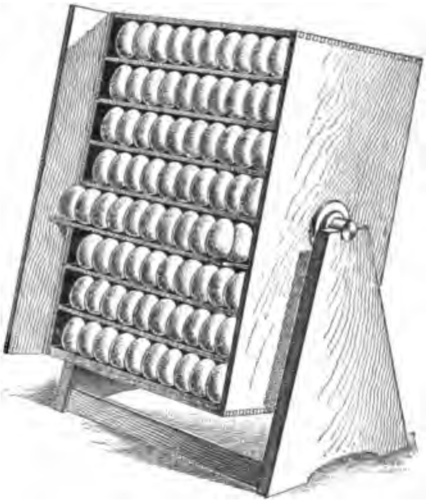

FIG. 1

temperature of about 55° F. in an atmosphere free from oil and bad odors. The best hatch is obtained from eggs placed in the incubator the same day on which they are laid. Eggs keep in prime condition for hatching up to the tenth day; if 2 weeks old they are safe for incubation; but if older than this they seldom hatch well, although some eggs that have been kept a month will hatch.

9. It is best to avoid the use of eggs for hatching that have dirt or stains on the shell, but if for any reason it is desirable to use such eggs for hatching, the shells should be dry-cleaned as well as possible; under no circumstances should they be washed. Dirt can be removed from eggshells with a dry cloth and if necessary the dirt may be loosened with the thumb nail or a dull knife. Washing removes the natural glaze from the surface of the shell, and eggs that are washed do not hatch so well as they do in their natural condition. Soiled eggs will hatch better in their soiled condition than they will after they have been washed.

INCUBATORS AND THEIR MANAGEMENT

INCUBATORS

10. An **incubator** is an apparatus by means of which eggs may be artificially kept at the proper temperature for hatching. In the attempts to lessen the amount of labor expended in growing poultry, and to make possible the growing of a large number of birds in all countries at all seasons of the year, many different kinds of incubators have been invented. There are many different styles and sizes of incubators now in use, some of them being adapted for all sizes of eggs from those of the Bantam to those of an ostrich. Incubators range in size from those the capacity of which is limited to a few dozen eggs to those that are capable of incubating many thousand eggs. The machines most commonly used have capacities that range from 5 to 30 dozen hen's eggs or a smaller number of any eggs that are larger than hen's eggs.

There are many different types of incubators made, but with few exceptions their outward appearance conforms to a greater or less extent with the one shown in Fig. 5. As far as appearance goes, the main difference in incubators is due to the different types of heater used and to differences in the finish of the cases. The essential parts of an incubator consist of a heating apparatus that is controlled by a regulator, and an egg chamber that can be held at the required temperature. Incubators are also supplied with thermometers and means of ventilation.

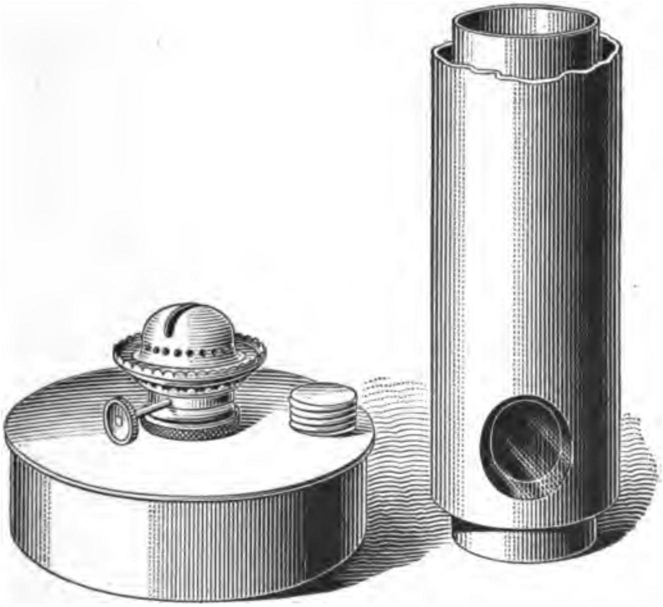

FIG. 2

11. Heat is brought into contact with the eggs either by diffusion or radiation. In **diffusion incubators,** hot air is evenly distributed throughout the egg chamber. In **radiation incubators,** the heat is radiated from pipes or radiators that are heated either by hot air or by hot water. A large part of the incubators in use are of the diffusion type, in which the air is heated by an oil lamp. In these machines the heated air passes directly into the egg chamber and throughout the interior of the machine. The eggs in the tray are thus surrounded with air at the required temperature. Incubators in which the heat is both radiated and diffused are also used. The more evenly the egg chamber is warmed the greater will be the success in hatching.

12. Source of Heat.—The most satisfactory heat for incubators is that obtained from **oil lamps,** which are used at the present time on incubators of all kinds. For safety and best results, the lamps are made of strong metal, as shown in Fig. 2, and are seamless as far as possible, all joints being closely seamed and soldered. Lamps made of light-weight metal or tin, and that depend entirely on solder to keep themselves intact are not safe for incubators, as such lamps become hot during use and are liable to explode. Besides, they are apt to leak, and the heat from lamps that are themselves overheated cannot be controlled readily. As the burner and wick are of as much importance as the lamp, they must both be the best that are made for the purpose. Inferior burners and wicks are unsafe, and they should find no acceptance with the scientific breeder of poultry. Chimneys made of metal are safe and durable; glass chimneys become heated and are easily broken. An extra lamp or two with several extra burners should be at hand as an emergency supply; an entire hatch may be saved by this precautiom.

13. Large **water tanks** with a capacity of many gallons can be used to warm the egg chambers of incubators. These tanks are filled with boiling water and the heat from the tank warms the eggs. A number of gallons of water are drawn each 12 hours from the bottom of the tank, and an equal amount of boiling water poured into the tank from the top maintains a uniform temperature. This system was first used by the French, and afterwards by the English manufacturers, who termed it *hydro incubation*, or *incubation by water*. The same system was used in the United States about 1879. Later a lamp was used to warm the water in the tank. Surprisingly good results can be obtained through the use of this system, but the labor of refilling the tank and the danger of leakage from the tank overbalance the good points of this heating system. From this system have developed many types of incubators that contain tanks and pipes. All of these devices involve much care and labor in their operation, and are also troublesome from the occasional breaks that permit the water to dampen the egg chamber.

14. Hot water circulating through pipes or radiators is frequently used for heating incubators. The pipes are connected with a boiler and the water flows through the pipes and radiators back into the boiler. This circulation maintains a constant heat current throughout the machine. The water pipes and radiators are placed above the egg chamber, or both above and beneath it. In this system, the water is heated by a lamp and flows from the boiler or heater throughout the system of pipes and radiators. This system, like other heating systems, has its advantages and disadvantages. By its use the heat is maintained for a considerable length of time even though the lamp is extinguished; but if the heat is excessive, it is the longer in cooling down. Leaks may occur in the pipes; and if such leaks are neglected, the water supply may be lost and the egg chamber deluged with water. There is less trouble from lack of moisture and a greater chance for an excess of it in this system than in any other system. All incubators must set level for best results, but this is indispensable with the hot-water system. The success of this system depends on the circulation of the water, the distribution of the pipes, and the lasting qualities of the entire heating system.

15. Illuminating gas is also used as a means of heating incubators; special gas burners are made for incubators, and by the use of these burners, reasonably good results may be had. The difficulties and expense that attend the use of gas bars it from general use. If, however, gas is conveniently located it can be quickly attached to the incubator. Electricity for heating is used also to some extent in both incubators and brooders. Water heaters fired with coal are employed for heating water-current systems in incubators. Lamps that burn alcohol are used for heating machines of special make. Alcohol lamps may be used for many days without changing. All of these methods require special attachments or devices that in different ways serve the one general object of supplying uniform heat continuously. The principal requirement for purposes of incubation is a source of heat that can be governed or controlled, so as to insure the probability of keeping it at the proper temperature for hatching.

16. The odor from the lamp or accumulated soot endangers the hatch if it gains access into the machine. Fumes from oil, decayed vegetables, and mold, and stagnant air are injurious if they gain admission to the egg chamber. The heat current carries fresh air or bad fumes with equal readiness, and wherever the current of air goes the odors it carries go with it. It is obvious, then, that the heated air within the egg chamber must be free from all contaminating effluvia, for the embryo in the egg is in contact with the air within the egg chamber and it may develop or die under the influences that surround it. The entire environment must be invigorating and sanitary, or development of the embryo is not successful.

17. Degree of Heat.—Eggs hatch best in an incubator at a temperature of 103° F.; but they hatch fairly well in a temperature that varies from 101° F. to 103½° F.; and they may hatch if the temperature goes as low as 99° F. and as high as 106° F. Under the influence of low or irregular temperature, the hatch is delayed and the number of chicks obtained is a matter of uncertainty. The location of the thermometer and the construction of the incubator have some influence over the reading of the thermometer, but this does not alter the fact that the eggs must be incubated in a normal heat of 103° F. If the incubator is in a cold room, a temperature of 1 degree more is required than is necessary in a warm room or in hot weather. The heat under hens varies quite as much as is permissible with incubators. The per cent. of hatched chicks is not so large from sitting hens that vary in temperature as it is under hens having a body temperature that is constant or nearly so throughout the incubation period. A regular temperature that does not go below 102° F., nor above 103° F., is normal for the incubation period, except at the time of turning or cooling of the eggs. If the heat goes below normal, the hatch is delayed; if it goes above normal, the hatch is hastened; as a consequence of either of these conditions the eggs may be destroyed.

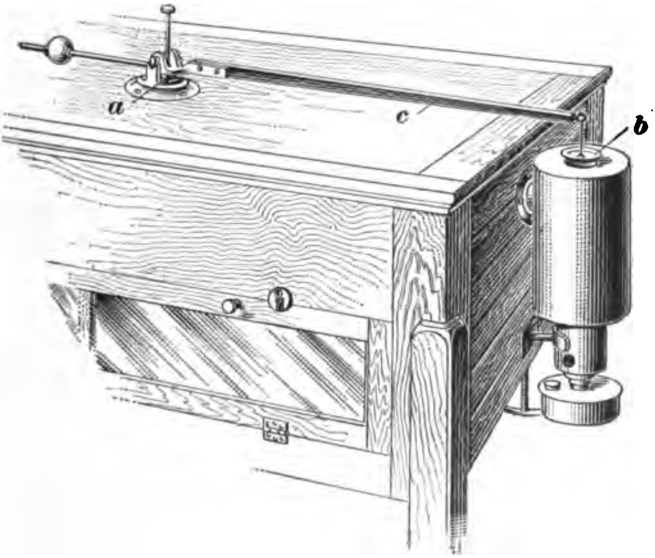

FIG. 3

18. Control of Heat.—A regulator is used as a help in controlling the temperature in the egg chamber. Its function in the general heating system is, to a limited extent, to prevent overheating by opening the draft pipe, or exhaust, at the top of the heater, thus permitting the heat to pass out through the top of the heater. A common type of regulator is shown in Fig. 3. The **thermostat,** which is located inside the egg chamber, expands and contracts with the rise and fall of temperature in the egg chamber, and whenever the temperature exceeds 103° F. the expansion of the thermostat moves the arm *c* of the regulator, which lifts the lid *b* from the outlet and gives free escape for the heat. As the temperature inside falls, the thermostat contracts and causes the outlet to close. The movement of the arm *c* is governed by the adjusting nut *a*. This nut is turned down or up as necessity requires. If the arm fails to lift the lid at the proper time, the nut is turned down. If it lifts the lid too soon, the nut is loosened or turned up. The adjustment of the heating apparatus must be perfected before the eggs are put into the incubator, and it is closely watched until the arm lifts or lowers the lid when the heat changes as much as 1 degree within the incubator. When properly set, the arm should hold the lid free from the top of the opening, thus avoiding overheating and improving the ventilation of the machine.

19. The size of the flame of the lamp determines the heat inside the egg chamber. This flame should be of a size that maintains a uniform temperature within the incubator. If the flame is too large, the regulator will not keep the temperature as it should be; if too small, the heat in the egg chamber will be insufficient. The flame must be adjusted to a nicety, so that the lid of the regulator will hang free and change but little. When too high, the flame burns irregularly, smokes, and goes out; the inside of the chimney and heater becomes coated with soot, and a poor hatch results. When the lamp is lighted, the flame should be set low and turned up gradually to the proper size, thereby obviating the trouble of smoking lamps and assuring a regular flame. The flame should burn continuously at a constant height above the cone of the burner. The proper height of flame can be ascertained after a few adjustments, and it is then a simple matter to keep it at the same height. A flame of proper size produces a little more heat than is generally needed. This surplus heat passes away through the draft or it is retained by the regulator if it is needed in the egg chamber.

20. Thermometers.—Incubator manufacturers prefer **thermometers** specially made to suit each kind of machine.

There is usually a reason for such preference, and the thermometer recommended by the manufacturers should be favored. If this instrument cannot be obtained, the best that is made must be selected. Incubator thermometers are scaled from 90° F. to 110° F., and are marked *low* at 100° F. and ***high*** at 105° F., and the scale is crossed at 103° F. by an arrow or a heavy line. It is thus easy to make an accurate reading between the low and the high marks, provided the thermometer is correctly graduated.

21. Before being used, incubator thermometers should be tested in the following manner: An instrument known to be correct is stirred about in warm water until the degree of heat is 105° F. or a little higher. Other thermometers are then held in the same hand with the one known to be correct and all are stirred about in the water so that the reading of all may be taken under like conditions. Any instruments that fail to mark the temperature correctly should be rejected. It is best to test all thermometers in use at least once a season.

22. The printed directions that tell how to run each variety of incubator also indicate the place for the thermometer in each machine. These directions must be followed to the letter, because the correct reading of the thermometer depends on its location. If it is placed in contact with fertile eggs, the degree of heat registered is higher than that of the thermometer the bulb of which rests on infertile eggs. If the thermometer is suspended, the reading will also depend more or less on its height above the eggs. To have the reading correct, the thermometer must be located and read according to the directions for operating each kind of incubator.

Unless special directions are given to the contrary, the thermometer is placed in or near the center of the egg tray. One instrument in the middle of the egg tray, one in the right-hand corner in front, and one in the left-hand corner in the rear will give the temperatures of the three important points. It is always well to use at least two thermometers in an incubator, and more than this number is desirable if the machine is large. By the use of several thermometers trouble that comes from the defective thermometers may be avoided.

23. The distribution of heat is perfectly uniform in few, if in any, incubators. It is always advisable to have a thermometer in the hottest place in order that excessive temperatures at this place may be guarded against. The hottest place in many cases is found only by carefully observing the readings of the thermometers in different parts of the egg chamber.

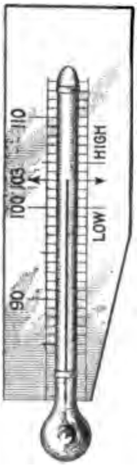

FIG. 4

24. When used in an incubator, the **universal thermometer,** shown in Fig. 4, is suspended from the roof of the egg chamber, laid on the eggs, inclined on a holder, or placed between the eggs in the tray. The bulb of this thermometer is exposed. When it is used for direct-contact reading, as shown in Fig. 7, the bulb rests against or between the eggs. With the use of a holder, this thermometer will do service in any of the positions mentioned above.

25. Suspended thermometers are suited to incubators in which the heat is diffused, but such thermometers fail to record correct temperatures when used in incubators in which the heat is radiated from water pipes or other radiators. The average distance from the bottom of the egg tray to the top of the eggs in the tray is from 1¾ to 1⅞ inches. When suspended thermometers are in position as shown in Fig. 5, the center of the bulb of the thermometer is usually on a level with the top of the eggs. In some incubators, however, the thermometers are elevated above the top of the eggs. The suspended thermometer is a convenient one to see and read; its position is not changed when the eggs are turned, and if the temperature is properly adjusted to its location, there is not much danger of wrong temperature in the egg chamber.

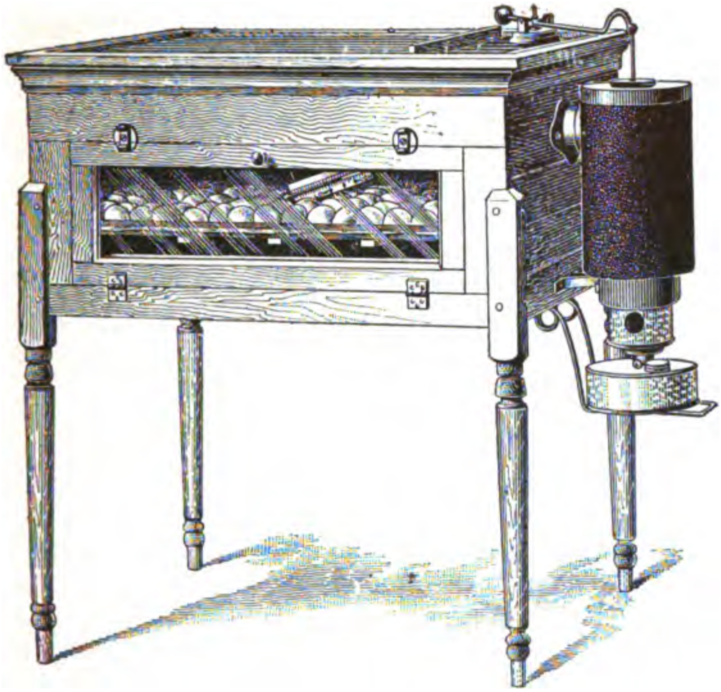

FIG. 5

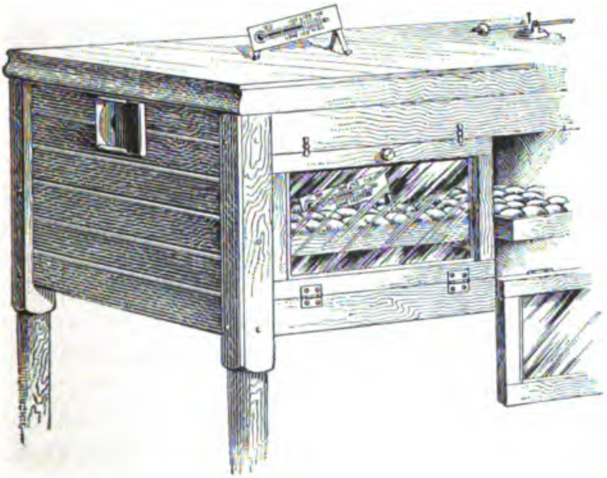

FIG. 6

26. Inclining thermometers, or thermometers that rest on legs or holders, should be set into the egg tray, as shown in Fig. 6. The legs of the thermometer shown are stationary, and not adjustable; when it is in use the distance of the center of the bulb from the bottom of the egg tray should be less than 2 inches, or the bulb should be on a line with the top of the eggs. The inclining thermometer can be placed in any part of the tray, or several instruments can be used.

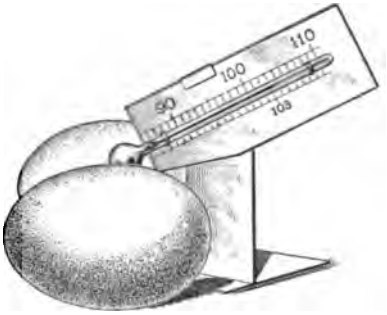

FIG. 7

27. By the use of **contact thermometers,** or thermometers the bulbs of which touch the shells of one or more fertile eggs as shown in Fig. 7, *contact readings* of the temperature of the eggs may be obtained. A thermometer the bulb of which rests against a fertile egg shows a higher temperature than another thermometer alongside that does not touch the eggs; or the same thermometer resting against an egg having a dead germ may record a temperature lower by a full degree than the one that does not touch the eggs. The reading of the contact thermometer should be compared with the readings of the other thermometers in the same tray. Contact thermometers should be held in a fixed position or should be attached to a support, to prevent them from moving about or from falling down between the eggs when the tray is jostled; and to prevent the bulb from being set too high or too low in the tray.

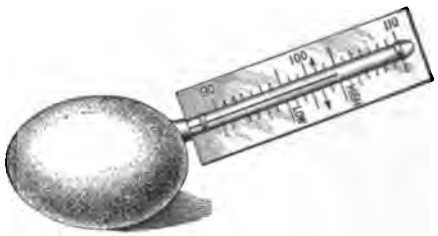

FIG. 8

28. An **egg-bulb thermometer,** or thermometer with an artificial egg for a holder, as shown in Fig. 8, is used to record the temperature at the center of the eggs in the tray. The celluloid egg holds the thermometer in position among the eggs in the tray, the bulb of this thermometer being in the center of the artificial egg. The temperature shown by this thermometer should be 101° F., or a little more, for the center of the egg, in contrast with 103° F. the proper temperature at the top. If desired, the temperature of incubation may be recorded by the exclusive use of this type of thermometer.

29. Alarm thermometers, or thermometers with electric attachments for sounding an alarm if the heat goes too high, can be used in the egg chambers of incubators. Such an instrument is shown in Fig. 9. Small electric lamps may also be installed inside the incubator. Both the lights and the alarm are operated by storage batteries. The lights are turned on by pressing a button and plainly reveal the temperature reading of the thermometer in the tray.

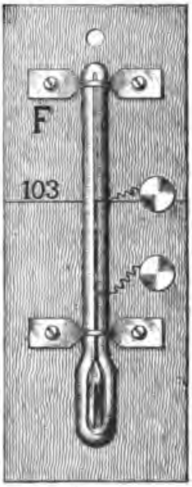

FIG. 9

30. Reading of Thermometers.—In observing the degree of heat recorded by a thermometer, care should be taken to see that the column of mercury is continuous and is connected with the mercury in the bulb. If breaks in the mercury column are noticed they may be obviated by holding the thermometer in the hand, bulb down, and by giving the hand a quick downward swing, with a sharp stop at the end, the mercury thus being settled into the bulb. If not properly settled, air spaces divide the column; when properly settled, the mercury is a solid line. As soon as the door of the incubator is opened, the temperature declines, and it does not regain its original height for at least an hour after the door is closed. The temperature of the thermometer should therefore be read through the glass in the door before the door is opened to turn the eggs. The temperature should be noted frequently for the first 3 or 4 days of the hatch, its rise or fall carefully observed, and the regulator adjusted so as to keep the heat at the right point. When this adjustment is assured, less frequent readings are required.

MANAGEMENT OF INCUBATORS

HEAT, MOISTURE, AND VENTILATION

31. Heat.—In natural incubation, the proper degree of heat is that supplied by the body of the hen, when the eggs in the nest are evenly warmed. In artificial incubation, the same degree of heat is sought, and an even distribution of heat is quite as essential as the proper degree of heat. A uniform distribution of heat produces an even temperature throughout the egg chamber and avoids cool corners or hot areas in the egg tray. With such distribution, the hot-air currents flow into the egg chamber, are equally diffused in different parts of the chamber, and keep the eggs at a uniform temperature. A uniform distribution of heat may be obtained by passing hot air into metal radiators, which throw heat by radiation into the egg chamber. Heat from hot water is equally satisfactory and is, as has been said, a suitable heat for incubation.

32. Moisture.—During incubation, a portion of the **moisture** in the egg is evaporated, and the rest is absorbed by the growing embryo. As the moisture content of the egg grows less, the air cell becomes larger. If the egg chamber lacks moisture, the eggs dry more quickly than they do if a normal amount of moisture is maintained. If the air is caused to move quickly through the machine, there is an increase in the rate of evaporation. The normal size of the air cell of an egg during incubation was shown in *Natural Incubation*. If the air cells of eggs that are being incubated are smaller than normal, there is a surplus of moisture in the air; if greater, there is either a lack of moisture or too much ventilation. Excessive evaporation is evidence that moisture is lacking and that the dry, hot air is taking the life from the eggs. An active circulation of dry, hot air long continued will destroy embryo life inside the shell. With excessive evaporation and lack of moisture, even fairly good results are not had from incubation. If moisture is excessive, the chicks will be drowned within the shell. A natural amount of moisture, about the same as with hens, is necessary for success in artificial incubation.

33. Hygrometers.—When the air contains all the moisture it is capable of holding, it is said to be *saturated*, or to have a mean relative humidity of 100 per cent. The mean relative humidity of the air is measured by the **hygrometer.** There are many kinds of hygrometers. One type well suited for use in incubators is shown in Fig. 10. In this instrument, the mean relative humidity of the air is indicated directly, and by the use of this hygrometer it can be ascertained whether or not there is enough moisture in the air in the egg chamber or the nursery below it. The normal mean relative humidity of the air under the hen on the nest is about 60. More moisture than this is not needed, and good hatches may be had with less. Hot air evaporates moisture and enlarges the air cells of the eggs. When the air cells are smaller than normal, they may be enlarged by more ventilation and less moisture. If moisture is lacking inside the egg chamber, it must be supplied.

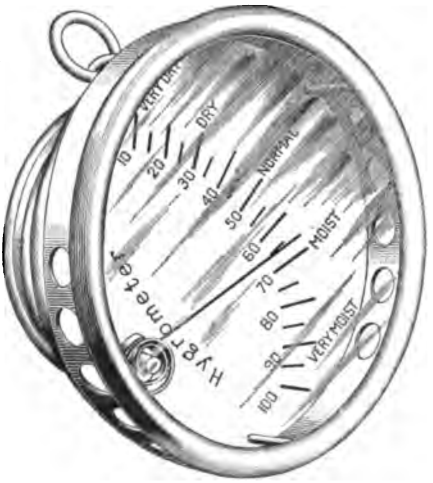

Fig. 10

34. Ventilation.—Moisture is largely controlled by ventilation, for it is by this agency that the air is moved through the egg chamber. If the ventilation is excessive, too much moisture is taken from the eggs; if there is not enough ventilation, the air becomes impure. Proper ventilation is of vital importance, and it must be rigidly maintained: Moisture and ventilation are not controlled in the same way in all incubators. The directions for operating each kind of incubator are explicit with reference to these two matters and it is usually a safe, correct practice to follow these directions closely.

LOCATION AND CARE OF INCUBATOR ROOMS

35. Location.—Incubators may be located in outbuildings, living rooms, cellars, or in buildings erected for the express purpose of supplying an incubator room. Incubators do well in rooms where the temperature ranges from 60 degrees to 70 degrees, but their efficiency is not seriously impaired in a temperature as low as 40 degrees. A cellar that is dry, well ventilated, and of an even temperature is a suitable place for them, although preference should be given to a basement or a room partly above and partly below the surface of the ground. The best place is such a room of even temperature, that is dry, well ventilated, and well lighted. The air in the room circulates through the incubator and through the system of the embryo chick; and air that is unfit for human lungs is detrimental to the chick. Where the ventilation is bad, the air becomes saturated with lamp fumes and poisonous gases, which go with the air into the egg chamber and are injurious to the embryo in the egg.

Rooms, basements, or cellars that are heated with hot air from a furnace are not well suited to incubators, because there is so little moisture in the air. Heat from steam pipes or radiators is equally objectionable for the incubator room. Heat from hot-water pipes is least objectionable, and they have the additional advantage of furnishing an even heat. The use of heated rooms for incubators naturally calls for the addition of moisture to insure a reasonable per cent. of humidity in the air.

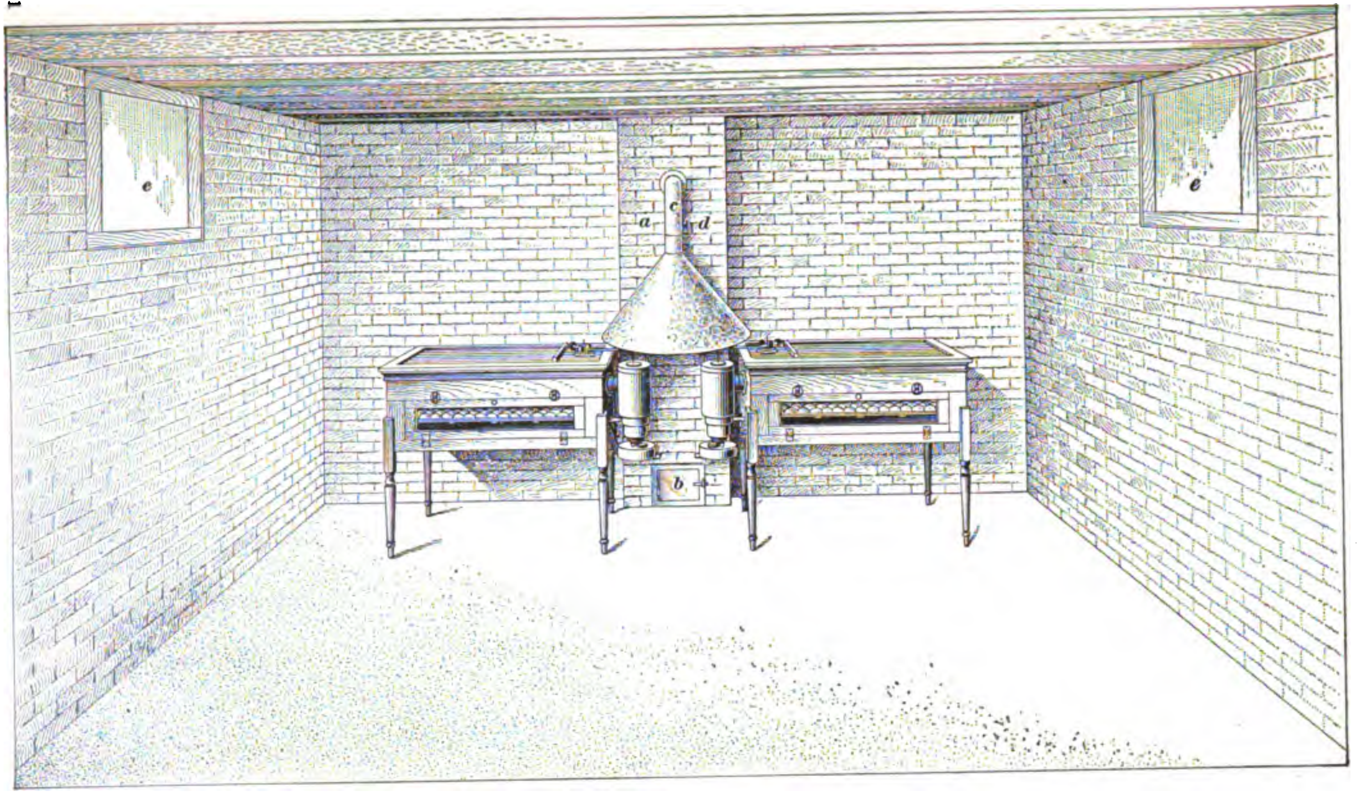

Fig. 11

36. An unheated basement or cellar is well suited for incubators provided it is neither damp nor badly ventilated. Satisfactory results may be reached where changes are made to relieve poor ventilation; the best obtainable results may be had in cellars especially prepared for incubation purposes, as shown in Fig. 11. In this arrangement a brick chimney *a* that leads from the cellar out through the roof has an iron door *b* that can be opened or closed to relieve the interior of dampness and to improve the circulation of air. The incubators should be placed against the wall, with a hood made of galvanized iron extending over both lamps, as shown, and a small draft pipe *c* should connect it with the chimney. The regulator *d* may be turned as needed to increase or to diminish the draft through the pipe; the odor from the lamps passes out through the pipe. The hood and pipe are a safe means of ventilation. The windows *e*, which are the openings through which the air enters, are above ground and are closed with heavy muslin. Circulation can be controlled by opening or partly closing the outlets *b* and *c*. If the intake through the windows is excessive, it may be reduced by closing the opening with a glass window on the side from which the wind comes.

37. Care.—All avenues of circulation and ventilation must be changed to conform to weather conditions. When the wind blows cold or the thermometer goes to zero or below, less ventilation is needed; when the weather moderates, ventilation should be increased. The size of the flame of the lamp should be increased to meet the changes to zero weather and decreased as the weather becomes warmer. Sudden changes in temperature must be guarded against by setting the lamp flame to meet them; these conditions should be closely watched by the operator, who soon becomes familiar with needed changes.

38. Besides the use of **moisture pans** for increasing the amount of moisture inside of the egg chamber, other means are usually necessary in the room where the incubator is located. Simple methods are to pour water on the floor or to place flat pans filled with water under the incubators. Tubs or buckets filled with boiling water may be placed inside the incubator rooms; the steam from the water in these vessels is an abundant source of moisture to the air. Pumps may be used for throwing hot spray on the ceiling, the side walls, or the floor. This procedure rapidly increases the quantity of moisture in the air of the room. Disaster usually follows the rash use of moisture in the incubator room. A thorough knowledge from observation and experience is the only guide that assures beneficial results from moisture added artificially to the atmosphere of the incubator room.

OPERATION OF THE INCUBATOR

39. Location of the Incubator.—The incubator should be placed against the wall or close to it, and where the lamp, the regulator, and the doors are easy of access. It must be set perfectly level, or the heat will be uneven and the flame

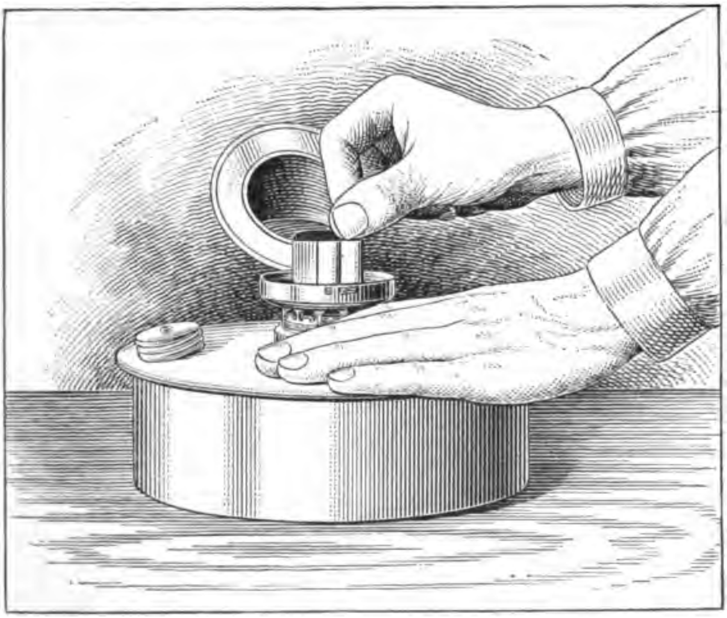

FIG. 12

of the lamp untrue. Sunshine or direct rays of light entering the egg chamber are detrimental and they may be avoided by darkening the windows of the room or the doors of the incubator with curtains.

40. Care of the Lamp.—The lamp must be filled each day, usually in the evening, with the *very best oil* that can be obtained. Oil of less than 150 degrees fire-test should not be used. A new wick should be used for each hatch, and the lamp and burner must be thoroughly cleaned each time the lamp is filled. The wick should be trimmed with the thumb and forefinger, as shown in Fig. 12, or with the blade of a knife. All the charred portions must be removed from the wick, and the burner, which is shown more clearly in Fig. 13, thoroughly cleaned with a brush. If the opening *a* close to the wick flue *b* is closed, or if the gauze *c* is covered with oil or dirt, the flame of the lamp will burn irregularly and smoke. The heat flues of the incubator will then be filled with soot, which will give the egg chamber a bad odor. Lamps should not be quite filled with oil, and they must be wiped dry and clean with a cloth each time they are filled.

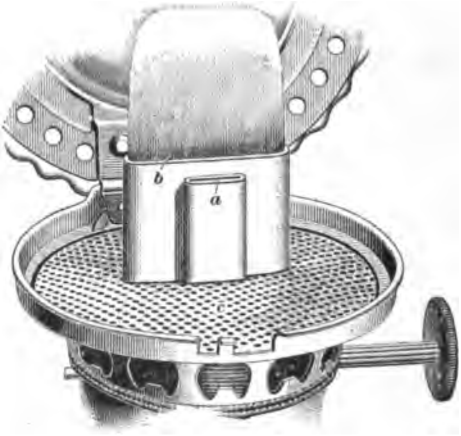

FIG. 13

In warming the heater, a moderately small flame is used at first and its size is gradually increased until the heat desired is obtained. After the egg chamber is heated to 103° F., the regulator and the flame of the lamp are adjusted so that this temperature is maintained. The flame is set so that the cap is held free from the outlet of the heater, and the regulator is adjusted to keep the heat at 103° F. When the lamps are filled and cleaned, the flame should be set and watched until it settles to its proper size and the required temperature is established. An even flame under control needs attention only twice in 24 hours. The size of the flame is reduced during hot weather by clipping the corners from the wick.

41. Care of the Heater.—Dirt, smoke, soot, or grease inside the heater and flues should be prevented by thorough cleaning. Stiff brushes, cloths, and even soap and hot water may be used for cleaning purposes. When necessary, the heater can be detached from the incubator and all parts thoroughly cleaned. Smoke or soot fumes must be excluded from within. Grease or a coating of oil and soot can be removed from the inside of the heater and from the chimney and mica by washing them with a strong solution of sal soda in hot water. Strong vinegar will also clean grease or soot from the mica or chimney.

42. Warming the Egg Chamber.—The lamp, heater, flues, and egg chamber should be slowly warmed with a flame that burns moderately low in the lamp. A gradual warming that heats the chamber to the proper degree in about 12 hours is best. The incubator should be run empty for 1 or 2 days until a regular heat has been established, and the first hatch attempted by an amateur should be run through with eggs of little value. The experience gained from the first incubation period, or hatch, serves to guide in the handling of better eggs in future hatches.

43. Filling the Egg Tray.—A greater number of eggs will go into the tray when they are placed irregularly than will fit in rows. The proper position of the egg is on the side; but if either end is uppermost, it should be the large end and not the small end. Eggs in the nest under the hen rest on one side and not on either end. A similar position is best in the incubator. Only a single layer of eggs should be put into the tray; in the case of double layers, those on top are overheated. The eggs should be selected as has been directed, and the trays should be comfortably filled without crowding. The filled tray may now be slid into place in the egg chamber and the doors closed.

44. Warming the Eggs.—The cool eggs will lower the temperature inside of the incubator, and it may be 24 or 36 hours before normal heat is resumed. This gradual warming of the eggs is beneficial, for the germs may die during the first 3 days if a degree or two of overheating occurs during that time. The germs are destroyed during the first week in a temperature that may not be injurious at the close of the hatch. Warming the eggs hastily or overheating them is to be avoided. If the temperature is regular when the eggs go into the incubator, the heat should not be increased until after 2 days, and overheating must be guarded against. The size of the flame may be increased a little the third day if normal heat is not resumed; 102° F. is warmth sufficient for the first 4 days; then the heat may be gradually increased another degree.

45. Temperature Throughout the Hatch.—An even temperature throughout the hatch is best. The temperature should be kept at 102° F. for the first week and then raised to 103 degrees during the second week. An occasional temperature of 104 degrees or 105 degrees may exist during the second or third week without injury, but more than 105 degrees of heat for any considerable time is fatal to the hatch. A low temperature during the time of hatching is also fatal. If hatching begins on the twentieth day, it is evidence that the temperature has averaged high; if hatching is delayed beyond the twenty-first day, the temperature has averaged too low. The eggs of hens normally begin to pip or crack open at the close of the twentieth day, and the hatch is completed at the end of the twenty-first day.

46. Reversing of the Trays.—The eggs should not be turned during the first 2 days of the hatch; the trays should simply be drawn from the egg chamber, reversed, and put back. Should there be two or more trays in the machine, they ought to be both reversed and changed from side to side so as to equalize the heat in the egg chamber.

47. Turning of the Eggs.—Between the second and nineteenth days the eggs in the incubator must be turned

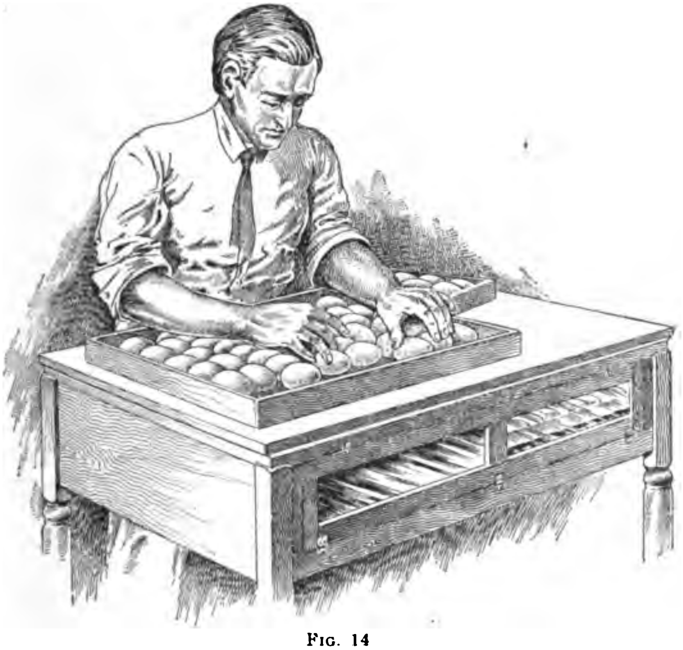

FIG. 14

twice a day, morning and evening. This should be done without jarring the eggs or turning them completely over from one tray to another. The tray of eggs is removed from the incubator and placed either on a table or on top of the incubator. A closed support beneath the tray will prevent a circulation of air passing through between the eggs. The eggs are turned in the tray, as shown in Fig. 14, by removing a row of eggs from one end of the tray; the remainder of the eggs are then moved about by the hands. The turning is done to lubricate the inside of the egg in order to prevent the clinging of the embryo, or the germ cell, to the inner membrane of the shell. When turned, the eggs are moved about to change their position in the tray rather than to turn them completely over. This moving of the eggs with the hands must be done gently so as to avoid jarring the eggs or cracking the shells. When the tray is not full of eggs they may be moved about with the hands into the center of the trays.

48. Cooling of the Eggs.—For the first week, the turning of the eggs cools them sufficiently; after that time they should be permitted to cool once a day. During the second week, if the temperature of the room is below 60° F., the eggs are returned to the incubator after 10 minutes of cooling. If the temperature of the room is above 60° F., they must be left to cool for a longer time. During the first part of the third week they should be cooled for a still longer period, but after the eighteenth day they do not need to be either turned or cooled. In a temperature of 45° F. or less, but little more cooling of the eggs is needed than that obtained in turning them. In a room that is cold, the eggs may be injuriously chilled in a short space of time, and in a room that is quite hot the eggs will take an hour to cool during the third week. The time allotted for cooling is governed entirely by the temperature in the room where the incubator is located. When returned to the incubator after cooling, the eggs will lower the temperature inside the egg chamber, but the proper heat will be regained in an hour or two without the making of any change in the adjustment of the flame or of the regulator.

From the fourteenth to the eighteenth day of incubation, the animal heat of the chicks within the eggs increases the temperature within the egg chamber. Close attention at this time ought to be paid to lamp flame and the regulator to avoid overheating. After the eighteenth day the eggs ought neither to be turned nor cooled.

49. Care of Eggs in Incubators.—Oil, grease, dust, or dirt on the eggs close the pores in the shell, thus preventing the necessary circulation of air in the egg and killing the embryo chick. Care must be exercised to avoid greasing the shells of the eggs or in any way soiling them when they are being turned. Dust and dirt must not be permitted to gather in the incubator room, and bad odors of all kinds should be rigorously guarded against. The doors of the incubator must be kept closed during the time of turning and cooling the eggs. To avoid jarring the eggs and the regulator, the doors of the incubator should be opened and closed as gently as possible. When the trays of eggs are removed from the incubator they should be handled gently to avoid jarring the eggs. The less the eggs are handled beyond the necessities of turning and cooling the better will they hatch. If the eggs are overheated in the incubator, the doors of the incubator should be opened, the eggs covered with a cloth moistened in water at 101° F., and the flame of the lamp lowered. The eggs should not be removed from the egg chamber and should be gradually cooled. As currents or drafts of air flowing into or through the incubator cool and dry the eggs, they should be prevented as far as possible.

50. Testing of the Eggs.—The eggs in the machine should be tested for fertility; this work may be done at the close of the fifth or sixth day of incubation, but it is most satisfactory when done during the seventh day. The manner of testing and the signs of fertility are described in *Natural Incubation*. Incubator eggs are tested one tray at a time. The act of testing turns and cools the eggs. When tested, one row of eggs should be placed at the far end of the tray on top of other eggs. As the testing proceeds, the fertile eggs should be placed in the vacant row in the tray, thus separating the tested from the untested eggs. They may also be kept separate by means of a flat stick. All eggs that are clear or that contain dead germs should be removed from the tray, the fertile eggs, being kept near the center of the tray, which is returned to the egg chamber. A second test must be made during the twelfth or fourteenth day, at which time all eggs containing dead chicks must be removed, leaving in the trays only the eggs that contain living embryos. A pencil of sunshine coming through a small hole into a dark room is an efficient light for testing.

51. Care of Incubator as Hatching Period Approaches. The doors of the incubator should be opened during the evening of the nineteenth day and the interior aired a little, but the eggs must not be removed from the egg chamber or moved about in the tray. The placing of burlap, felt, or cotton cloth beneath the trays or the removal of such material or the closing or opening of ventilators, moving of trays, or the making of other changes necessary to conform to the directions for handling the special make of incubator in use, should be made at this time. After these changes have been made, the doors of the incubator must be closed and not opened again until the hatch is complete. The experienced operator can tell at this time if moisture is lacking by passing the back of his hand over the surface of the eggs. When necessary, the shells should be moistened with a flat brush made of soft hair. The brush should be dipped into water as warm as the eggs are and the shells brushed over. No harm comes from moistening the eggs in this way at this time, even though benefit may not be derived therefrom.

52. The first peep that signals the living chick is sometimes heard in the egg chamber at the close of the nineteenth day; and these signals are frequently heard during the twentieth day. At this time close attention should be given to the temperature. The thermometer, the regulator, and the flame of the lamp must be closely watched and the temperature kept as nearly steady as possible at about 103½° F. This degree of heat should be carefully maintained up to and including the close of the twentieth day. If moisture begins to show on the inside of the glass in the door, it indicates that the hatch is under way; the absence of this sign denotes that few or no chicks are in the egg chamber. It is important at this time that moisture be kept inside the air chamber; this should be done even though ventilation is suspended; for if the moisture passes out of the egg chamber, the eggs dry down and the chicks are glued to the shell. Errors that have been made during the hatch cannot be corrected at this time by opening the door of the incubators; if the door is opened the eggs will be chilled and the moisture will escape from the egg chamber. An even temperature must be maintained throughout the twentieth day and the hatch allowed to progress without interference.

53. Care at Hatching Time.—Beginning with the close of the twentieth day the temperature may be permitted to rise to 104° F. Even 105° F. is not injurious at this time, but a temperature above this is unsafe for the hatch. When the chicks are coming out freely, the temperature should be permitted to rise as above indicated. The extent of increase of heat advisable is determined by the ease with which the chicks escape from the shell; if the chicks are slow to hatch, the temperature should be coaxed up to 104° F., or a shade higher to accelerate the process of hatching. Close attention must be given at this time to the heat within the egg chamber. It may be of value to the hatch to have the heat at 104½° F., but it is ruinous to have it a full degree higher. Delay in hatching proves that the temperature has run low at some period of incubation. In case of such delay, the temperature should be increased and the eggs left in the incubator a day beyond the normal time of hatching.

54. As the chicks dry off and become able to move about, they work forward in the tray, moving toward the light that comes in through the glass in the door. When they are close to the front they either drop below into the nursery, or cluster about the door at the front of the tray. The air in the nursery is not so warm as that in the tray, the difference being usually about 10 degrees. This lower temperature is beneficial to the chicks; after they are thoroughly dry they begin to move about and rapidly gain strength in both muscle and bone. During this day in the nursery they become accustomed to life, the yolk becomes assimilated, the legs of the chick are strengthened, and they are prepared for removal from the incubator. The tray should be taken out of the incubator on the twenty-second day; all broken shells and dead chicks should be removed; but if any live eggs remain unhatched, they should remain in the tray and be returned to the egg chamber.

55. Circulation should be reestablished inside of the egg chamber when the hatch is about completed. If the chicks pant or show signs of overheating before the hatch is completed, they must have air, to admit which the ventilators may be opened. If a large hatch is made and the chicks are crowding and panting for breath, the door should be opened and some of the strongest chicks removed. This must be done quickly to avoid chilling those not yet out of the shell. The ventilators should be opened during the last 12 hours in which the chicks stay in the incubator; also the doors of the incubator ought to be opened *just a little* during this time. The gradual cooling off hardens the chicks and fits them for the lower temperature they will have in the brooder. The thermometer in the egg chamber should show 100° F. during the process of cooling down. With this temperature 2 inches above the bottom of the tray, the heat in the nursery will be about 90° F. or a little lower.

56. Removal of the Chicks From the Incubator.—Eggs placed in the incubator on Monday evening should complete the hatch at the same time on Monday evening 3 weeks later. The gradual cooling off should commence the next morning and be continued until the following morning, when the chicks ought to be removed. Chicks from eggs placed in the incubator in the morning are usually removed 12 hours sooner than those from eggs put into the incubator in the evening. The evening start is preferred, from the fact that the chicks do better if they are not hurried from the nursery into the brooder. Chicks that are hatched from eggs put to incubation during the evening of Monday, do not need to be removed until the Wednesday morning of the third week thereafter. If from any cause the hatch is completed 12 hours or more ahead of schedule time, the chicks may be removed as if hatched on time.

Chicks that are hatched on Monday need not be fed until Wednesday; so that there is no reason for removing them before the morning of the third day from the beginning of the hatch. A portion of the yolk usually remains unassimilated until the fourth day. This fact is especially certain to be the case with chicks that are hatched artificially, for there is less need of body heat being drawn from food by them than by the chicks hatched and brooded by the hen. Chicks hatched artificially are constantly in an atmosphere warm and dry; and living in such an atmosphere they require less food for body heat than is needed by the chicks that have no shelter other than that supplied by the mother hen.

FIG. 15

57. Transferring of the Chicks to the Brooder.—When removed from the warm air inside the incubator, the chicks must be protected from the cold with woolen cloths, for if they are chilled during removal, their health may be impaired. They are safely moved, as shown in Fig. 15, in a basket that is lined with cloths that have been warmed by the heat of a fire or they may be moved in any other way that protects them from the chill of the air that is cold in comparison with the temperature inside the incubator. They must be protected from above with a warm cloth covered over them. A sudden chill at the time of removal retards the circulation of the blood and the assimilation of the yolk and may cause cold and bowel troubles. An excess of warmth, care, or coddling at this time is as dangerous as is a chill. When the chicks are properly treated, they prosper; but too much attention, too much food, or too much heat is detrimental; light, air, and a reasonable measure of exercise are best; quiet also adds to the comfort and welfare of the chick.

The chicks should be placed under the hover of the brooder and left undisturbed for an hour; at the end of that time they ought to be fed. For their first meal, sharp sand or fine chick grit may be given them on a clean board. If a few bread crumbs or a spoonful of rolled oats are scattered over this board, the chicks proceed at once to take their first food. How to fed them from this time forward is told in *Artificial Brooding*.

58. Care of Incubator After the Hatch.—When the hatch is completed and the chicks are gone, the entire incubator, both inside and out, including the lamp and burner, should be cleaned thoroughly. The wick must be thrown away and the burner boiled in water until all the dirt and oil are removed. When the burner is dry, a new wick should be put into place for the next hatch. A stiff brush is useful for cleaning the flues and heater; the inside of the incubator must be brushed or scraped to remove all trace of filth from the floor and tray. If necessary, the inside should be fumigated or sprayed to remove or to destroy germs that may have come with the last hatch. The thermometer must be examined or tested, the lamp lighted, and the incubator run empty for a day to assure an even temperature, after all of which precautions the incubator is in proper condition for another hatch.

COMMON FAILURES IN ARTIFICIAL INCUBATION

59. Death of Chicks in the Shell.—The chief cause of the dying of chicks in the shell is faulty incubation. Uneven temperature, or overheating is the principal direct cause of the loss. Should the eggs be chilled during incubation the chicks may die, but chilling occurs less frequently than overheating and uneven temperature and the loss from it is not so large. From overheating at the start, death may result when the hatch is coming off, for the weakened germ often lives through the period of incubation but does not produce a chick able to escape from the egg at the end of the hatch. Lack of vitality in the germ is another cause of death. When the eggs are good, they will hatch, provided proper temperature and moisture conditions are maintained inside the egg chamber during the period of incubation.

60. Deformed Chicks.—Chicks hatched with deformities are the result of uneven temperature, which causes the legs and feet to be spread, turned, or twisted in the unnatural efforts of the chicks to free themselves from the shell. Failure of the chick to absorb the yolk, the sticking of the chicks to the shell, overdevelopment, and underdevelopment may all be attributed to uneven temperature, improper moisture, or lack of ventilation.

61. Anemic Chicks.—Lack of vitality is the most discouraging of all the faults incident to chicks. This condition, as has been said, is caused largely by lack of vitality in the flock from which the eggs for hatching came. The chicks that move about but little, those that lack the power of quick motion, and those that have a bloodless appearance, are hatched from eggs that lack the vitality required for the production of healthy chicks. Strong, healthy chicks are not hatched from eggs that lack vitality; for no amount of care during incubation will strengthen these germs. A great many eggs of this kind fail to produce a living chick, and such chicks as do come from the shell alive have an uncertain tenure of life. They may be grown to market size only when experience guides the care that is given them. No amount of feeding can restore to them the vitality that is lacking. If some of them are grown to maturity, they live to sow the seed of greater loss. The manner or kind of incubation is not all to blame for the anemic chick; the fault for this is in the flock that lays the eggs from which the chicks are hatched.

62. **Faults in the Operation of the Machine.**—Bad odors and smoking lamps are often due to poor oil; and unless this fault is remedied the hatch will be spoiled. Imperfect lamps, short wicks, or wicks that are filled up in the web are also serious obstacles to success in artificial incubation. The best obtainable lamps and wicks are often faulty. If they are defective in any respect, they render the keeping of an even temperature difficult or impossible. An even heat current cannot be maintained unless the incubator is absolutely level on top. Flues that are clogged with soot fail in heating; oil-covered lamps soil the hands and pass the odor of oil through the heater into the egg chamber. The handling or turning of eggs with hands that are soiled with oil destroys the embryo in the shell. Too much haste in warming overheats the eggs and kills the germs; a sudden jar of the incubator separates the yolks in the eggs and the chick promptly dies. If the eggs are left out to cool until they are chilled, they will not hatch. Lamps irregularly filled, carelessly trimmed, and allowed to burn too high or too low assure failure, as will also neglect in turning and airing the eggs. If the operator neglects the eggs in the incubator, failure is as certain as it is when the hen neglects her nest.

Not all incubators are constructed alike; each kind has its own system of heating, moisture, and ventilation. The location of the thermometer is not the same in all, and while the same general principles apply alike to all, special rules must be observed in the operation of each, or failure is certain. The special directions for each type of incubator must not interfere with the general laws that are indispensable to successful incubation, nor can the system of artificial incubation be applied with good results unless the incubator in use is properly adapted to these general principles.

COMPARISON OF NATURAL AND ARTIFICIAL INCUBATION

63. Scientific investigation has shown that artificial incubation generally fails in supplying some of the conditions of natural incubation. These conclusions have been reached after thorough research by scientists in different parts of the world. Their work has included a comparison of the per cent. of eggs hatched under hens with the per cent. of those hatched in incubators, as well as investigations of the importance of moisture to incubation and the influence of various substances on the success of the hatch. The hope of experimenters is for information that will assist them in imparting knowledge that will (1) aid in the securing of an increased number of living chicks from incubators; (2) lessen the loss through lack of vitality in the germs; and (3) lessen the loss of vitality from faulty incubation. The experimenters hope to discover methods that will yield as satisfactory results in the artificial hatching of chicks as are obtained in natural incubation. Knowledge of this kind will be important as a guide in the construction of hatching devices. Under present conditions, the best results come from the use of incubators when strict attention is given to the special directions for operating each type of machine.

The best that can be hoped for in artificial incubation is that it will compare favorably with natural incubation. Incubators well attended to hatch on the average as many chicks as are hatched by hens that are equally well looked after. The incubator is not to be blamed for the mishaps that result from inattention or faulty handling of the incubator and eggs. Properly managed, incubators may be regarded as successful.

Artificial incubation that produces as many chicks as do the best sitting hens, may be counted as a success, provided that the chicks artificially hatched are equal in size, health, vitality, and living qualities to those hatched by hens. No amount of care can prevent the sitting hen from crushing eggs and partly hatched chicks. There are losses sustained under both natural and artificial incubation. The ultimate test of management is the minimum of loss.

64. Relative Efficiency of Incubators and Hens.—The efficiency of hens and incubators has been compared in many localities. These comparisons show the results gained from hens set in many kinds of nests under average conditions on the farm, on the town lot, and with the fancier who keeps a few hens. The average per cent. of chicks obtained from both hens and incubators is shown in Table I. The records of artificial incubation are derived from experiments with different makes of incubators.

TABLE I

COMPARATIVE EFFICIENCY OF INCUBATORS AND HENS

	Number of Eggs Set	Per Cent. of Eggs Tested Out	Per Cent. of Chicks Dead in Shell	Per Cent. Hatched of Total Eggs Set	Per Cent. of Chicks Dead at 4 Weeks of Age	Live Chicks at 4 Weeks, in Per Cent. of the Eggs Set	Number of Hatches
Hens	809	12·9	5·3	77·3	17·1	49·3	71
Incubators	5,978	19.2	15·0	45·2	24·1	37·7	68

The hatch from hens ranged as high as 83.3 per cent. and as low as 50 per cent., and that of the incubator from 77.1 per cent. to 32.5 per cent.

65. Relative Size of Chicks.—Chicks hatched by hens are a little heavier than the incubator chicks. Chicks gain but little if any in weight during the first 7 days, but in 3 weeks the gain is considerable. Twelve hen-hatched chicks weigh

16½ ounces while the same number of incubator chicks weigh 15 ounces. Chicks hatched with the proper amount of moisture are heavier than chicks hatched in dry air. This heavier weight does not, however, demonstrate that moisture increases vitality.

66. **Relative Evaporation.**—The loss in the weight of eggs during 18 days in an incubator varies from 10 per cent. to 19 per cent.; under hens, it varies from 9 per cent. to 14 per cent., with an average of about 12 per cent. If eggs dry down too fast, moisture added checks the loss; if they fail to lose moisture as they should, circulation of air causes evaporation. Experimenters say that there should be the same evaporation with the incubator as with the hen. At times the humidity is greater inside the egg chamber than it is outside; quite as often, the air is too dry inside the egg chamber. A remedy is sought for this condition and many experimenters claim that larger hatches are obtained from the same incubator with the use of moisture than without it, that the chicks are heavier, the down more profuse, and that the chicks are more vigorous, but they do not claim that moisture adds vitality to germs that are weak. The fact that added moisture improves the hatching quality of some machines does not prove that all incubators do better with its use. The lack of a proper amount of moisture inside the egg chamber is admitted to be detrimental to a successful hatch, yet this alone does not explain why the hen is more successful with the eggs than the incubator is likely to be.

67. **Carbon Dioxide.**—It has been discovered through chemical research that there is a larger percentage of carbon dioxide in the air under the hen sitting on eggs than there is in the air inside the incubator during a hatch. But no proof exists that the presence of a certain amount of carbon dioxide is necessary for the best success in artificial incubation. It is thought that a high per cent. of carbon dioxide was present in the hatching ovens of the ancient Egyptians, and it is known to be present in the hatching ovens now used

in China. How far its addition to the air in the incubator may go toward a betterment of the results in artificial incubation is not known.

68. Polish on the Shell.—Eggs under sitting hens acquire a smooth finish as the hatch advances. This finish on the shell is the result of the long-continued contact of the body of the hen with the shells. As the oil from her body partly closes the pores of the shell and causes it to become smooth, it may also lessen evaporation from the egg as the growth of the embyro increases. Although investigation in this direction has been limited, the fact has been proved that the quantity of oil on the surface of the shell increases throughout the incubation period. The influence of the oil on the success of natural incubation has not however been discovered. This oil, carbon dioxide, and moisture may be elements on which depend the highest success in artificial incubation.

ARTIFICIAL BROODING

BROODERS AND THEIR MANAGEMENT

BROODERS

1. A **brooder** is a device by the aid of which chicks may be raised without the care of hens. Within the shelter of the brooder the chicks are warmed, brooded, fed, and cared for; here they are sheltered from cold and wet, and in many kinds of brooders they have an open-air run. There are many kinds and sizes of brooders, some of which are adapted for use in the open and others for use in the brooder houses.

There is but little comfort for the chicks inside a brooder unless they have plenty of room, sunshine, warmth, and fresh air; a brooder that supplies all these necessities forms a comfortable home for the chicks. If any of the foregoing requisites are lacking, the strain of artificial brooding will be most trying on the vitality of the chicks and injurious to their health. The best brooders are those that have all the requirements necessary for growing the chicks to a healthy maturity.

2. Construction of the Brooder.—The essential parts of a brooder are the **hover** and the **nursery.** The hover takes the place of the mother hen, and the nursery is the living and exercising room; outside of the nursery there may be an enclosed run that is a near approach to the open range. The brooder must be built for warmth. The outside walls must be of sufficient thickness to shut out the cold and to

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retain the interior heat. There must be heating capacity enough not only to warm the brooder during moderate weather but to maintain a temperature uniformly warm throughout the coldest night.

The construction of the hover, the shelter under which the chicks go for warmth, is shown in Fig. 1. They seek shelter within the felt curtain just as they do under the mother's wings when they are brooded by a hen. The hover is the sleeping room in which the chicks spend more than half of their early existence in the brooder. When the air under the hover has a uniform temperature of the right degree and is free from poisonous fumes, it is healthful for the chicks.

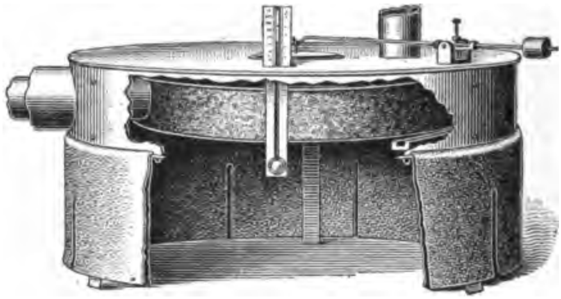


FIG. 1

If the hover is overheated and the air is laden with bad odors, it is unfit for the chicks.

The nursery of the brooder is the living room where the chicks go for food and exercise. The nursery, like the hover, must be evenly heated, but the degree of heat must be less in the nursery than under the hover. The nursery *n*, as shown in Fig. 2, surrounds the hover. It may extend across the rear side or through the center of the brooder. The style of construction is of minor consideration, since success may be achieved with brooders of all kinds. The nursery must be warmed and ventilated by the heating system so as to have healthful ventilation without strong currents of air.

3. Brooder Heating.—As with incubators, brooders may be warmed either by radiation or by diffusion. The heat may come into the hover either at the top, bottom, or sides. It does not matter how the heat is made; it is known as *top heat* if it comes from above. *Side heat* enters the brooder from the side, either by radiation from flues or heaters, by currents of heated air, or from pipes that are located about the side walls of the brooder. *Bottom heat* comes from below and warms the floor and keeps it dry. If the heat is mild and the floor is moderately warmed, comfort is given to the chicks. If the floors are hot, leg weakness and bowel troubles will prevail. A system of heating that brings the best results in some cases fails in others; and while top heat is most general, there are those who feel that successful brooding cannot be accomplished if this kind of heat alone is used. Brooders are well heated by a perfect union of top, bottom, and side heat. The greater number of all the artificially grown chicks are reared in brooders that are heated from above. When the temperature outside is low and the wind blows cold, a brooder is preferred that combines a full supply of top heat and warm fresh air with a little warmth under foot.

Brooders that are heated with lamps have the advantage of uniform heat and good ventilation, but these advantages are accompanied by the care of the lamps and the troubles and dangers attendant on their use. Lamps give the most satisfactory heat for small brooders, and they are also used for heating brooders that have a capacity for more than a hundred chicks. All of the several systems used in brooding have lamps as the source of heat for small brooders. Top heat, side heat, bottom heat, and heat from hot water can all be maintained from the heat of lamps. Lamp brooders are heated both by radiation and by diffusion. Radiators and pipes heated by lamps are used in hot-water systems; by their use, hot air is diffused throughout the hover and nursery.

4. Brooder Ventilation.—Fresh air for ventilation passes through the heater into the top of the hover, and from there it settles to the floor and flows out into the nursery; or it may pass directly from the heater into both the hover and the nursery. A diffusion of warm air is common to all systems, even though the heat may come from pipes or radiators. Ventilation by circulation comes from the flowing of hot air against the top of the hover. Ventilation like this carries warmth and fresh air throughout the entire brooder. When the system of ventilation is made a part of the heating system, an even distribution of heat is assured. Air should also be admitted through the windows of the brooder; less air is needed at night and during cool days than is necessary when the days are warm.

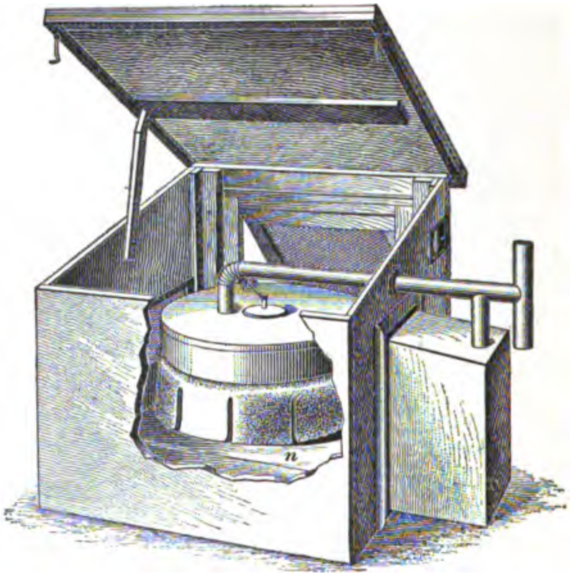


Fig. 2

5. Single-Lamp Brooders.—Many kinds of small brooders are classed as **single-lamp brooders.** This group includes the small single brooders of the type shown in Fig. 2 as well as the two-apartment brooders of the type shown in Fig. 3. Indoor brooders, outdoor brooders, colony-house brooders, and open hovers for indoor brooding are all included in this class. Sectional brooders, when heated with lamps, must also be included, although they are not actually single-lamp brooders.

The colony-house style of outdoor brooders may be set out in the open in all kinds of weather, but this kind of brooder gives better results when sheltered by a house or shed during winter weather. Outdoor brooders are safe to use in the open during moderate weather; but all brooders are more efficient when they are sheltered from the rain and the wind. Indoor brooders and open hovers for brooding must be kept inside of houses that are arranged for their use, as shown in Fig. 10 and Fig. 11, or where they will be sheltered from wet and cold. Individual brooders and open hovers are used for many broods in lamp brooder houses.

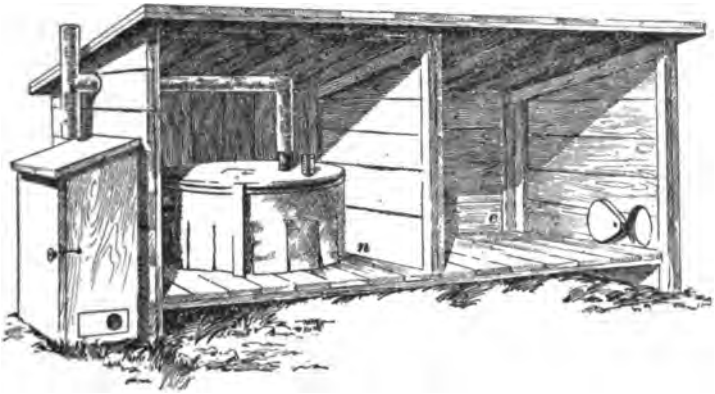


FIG. 3

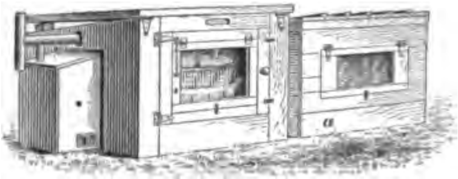


FIG. 4

6. Brooder for a Few Chicks.—For growing a few chicks, small individual brooders are best. Brooders of this kind are shown in Fig. 2 and in Fig. 4. Such brooders should be kept under shelter during the winter and early spring, and moved into the open when the minimum temperature is not below 50° F. These small brooders lack fresh air, ventilation, and floor space, but these disadvantages may be overcome by frequently cleaning the interior of the brooder and by elevating the top of the brooder from 1 inch to 6 inches for ventilation. When these brooders are moved into the open, home-made runways as shown at *a*, Fig. 4, can be added to the side of the brooder; these runways may be made from boxes or material of any kind that is suitable for the purpose. By the use of runways the chicks are given plenty of room for scratching. Runways of like construction can be added to all kinds and styles of brooders.

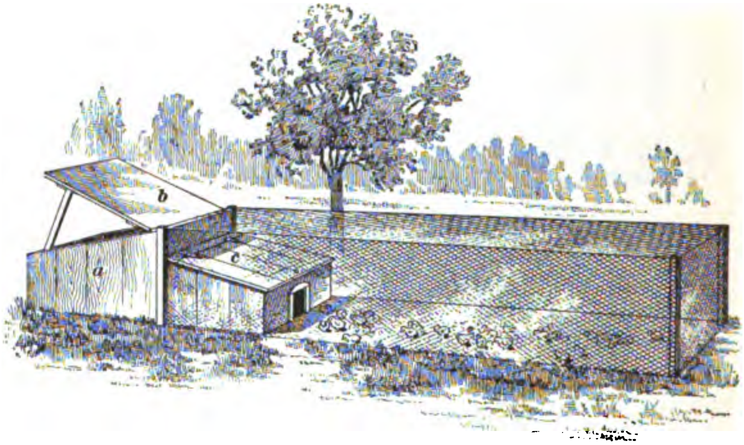


FIG. 5

7. Two-Room Brooder.—A brooder with two rooms like that shown in Fig. 3 has the triple advantage of the use of the hover for a sleeping room, the nursery *n* for a warm apartment, and the outside room *e* as a place where the chicks can exercise in cool air. When the sun shines through the glass into the outer room, the air inside of this room will be heated; at times the temperature may exceed the normal heat of the hover. When this high temperature occurs, the glass window should be opened wide to admit fresh air. The floor of the outer room forms a scratching place for the chicks, where they can have as much exercise as the chicks that are kept in brooder houses.

8. Brooders With Enclosed Runs.—Brooder chicks must be confined or they will wander away, and in the absence of the care of a mother hen may become lost for lack of knowledge of the location of their home. A plan for a small enclosure about a brooder is shown in Fig. 5. To make an enclosure of this kind, poultry fence netting is stretched and fastened on posts that are driven into the ground, so that the entire fence can be taken up and moved at will. To avoid danger from cats or hawks, wire netting may be stretched over the top of the enclosure. The hover room *a* should be opened during the day; the top *b* is elevated to admit sunshine and air; the top of the nursery *c* can be elevated for the same purpose. Both hover and nursery must be kept closed when the weather is wet or cold, and the chicks should be kept inside the brooder during bad weather. At first, a board should be placed across the enclosure 1 foot away from the outlet of the brooder. This board can be moved farther away as the chicks learn the way from the yard to the brooder.

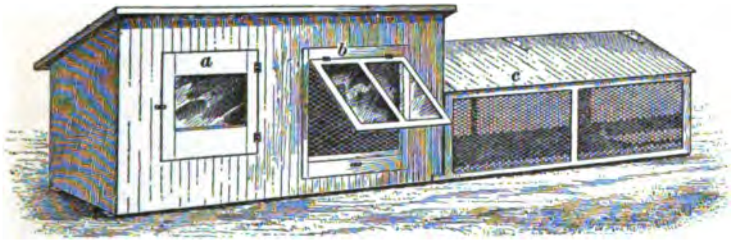


FIG. 6

When space is limited, or if for other reasons it is desirable to keep the chicks more closely confined, a colony brooder that has an outside run like that shown in Fig. 6 is best. This run gives safe protection to the chicks and will shelter them from the sun and rain. This kind of brooder should have flat runners under it, so that it can be moved about easily. The glass door *a* can be opened to admit air and sunshine into the hover; the door *b* opens into the nursery; the top *c* of the outside run can be raised or lowered in feeding the chicks or in caring for them.

Enclosed runs are also needed for the chicks that are grown in houses. These runs should slope gently toward the south and away from the house. Runs that are suited to a small brooder house are shown in Fig. 7. These runs should be enclosed and separated from one another with ½-inch mesh poultry netting. The wire confines each lot of chicks to one enclosure and prevents them from mixing together or from going outside of the enclosure. An enclosure of this kind will answer for a house like the one shown in Fig. 10. The soil inside of these runs must be frequently freshened by digging, turning, and raking, or otherwise it will become tainted. By doing this the top soil is turned under and the fresh soil is brought to the surface. There is less danger of sandy soil becoming tainted than soil in which clay abounds.

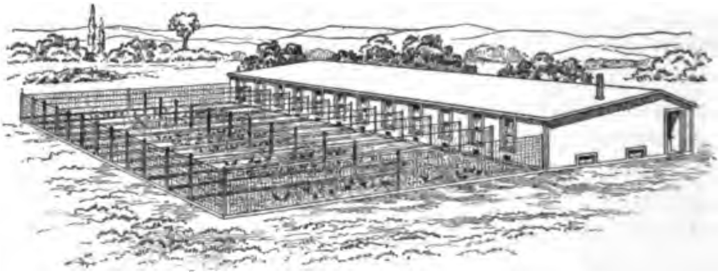


FIG. 7

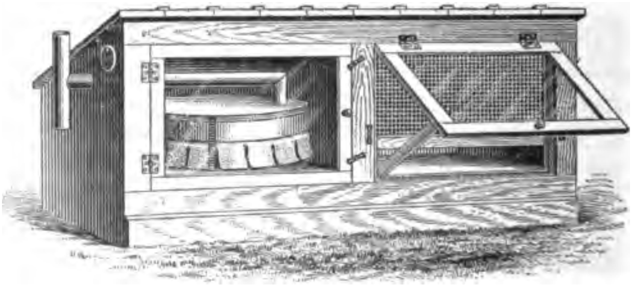


FIG. 8

9. Colony Brooders.—The type of brooder shown in Fig. 8 serves early in the season as a two-apartment brooder and an outdoor brooder, and later in the season as a colony coop for the growing chicks. When the brooder is used as a colony coop, all of the interior partitions should be taken out and a roost pole put inside of the coop, as shown in Fig. 9. The roost pole should be at least 3 inches wide on top, and should be placed about 1 foot from the back of the house and 8 inches above the floor.

Since colony-house brooders and open hovers have come into more general favor, the use of sectional brooders, or two or more joined together, has been largely discontinued.

10. Indoor Brooding.—Successful brooding can be done indoors, provided the room where the brooders are placed is warmed with a stove or by other means. A large number of brooders can be placed inside of a room that has been specially equipped for them, as shown in Fig. 10. From this method of brooding, successful results can be obtained, and a large number of chicks can be grown during the coldest weather if the room is kept comfortably warm. While a stove may be used to warm the room, hot water in pipes is a much better source of heat. The pipes for the water can be ranged against the wall in the hall as shown at *a*. The stove *b* for heating the water must be in the basement, thus assuring a return flow for the water. The brooder lamps are cared for in the hall without making it necessary for the attendant to go into the runs with the chicks. The

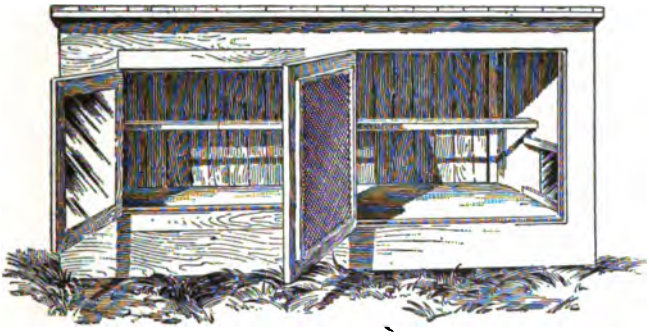


FIG. 9

retaining boards *c* will keep the untaught chicks close to the brooder.

11. When **open hovers** are used instead of brooders, they are placed in the same manner as the brooders shown in Fig. 10. Open hovers can be used inside a colony house or in a building where they will be protected from the wind and cold; those shown in Fig. 11 are inside a colony house. The hovers must rest on boards and must be elevated above the floor of the room. When used inside of colony houses or in other buildings, the pipes *b* for heating should come from the lamps in the boxes *d* through the wall *c*; fumes and heated air will then pass out through the outlet pipe *a*. Boards *e* that are a foot wide will separate the broods until the chicks are able to fly over the boards; when they are able to do this each brood will know its own hover and the boards can be removed. This system of brooding young chicks is more generally used than is the water-pipe system for brooder houses.

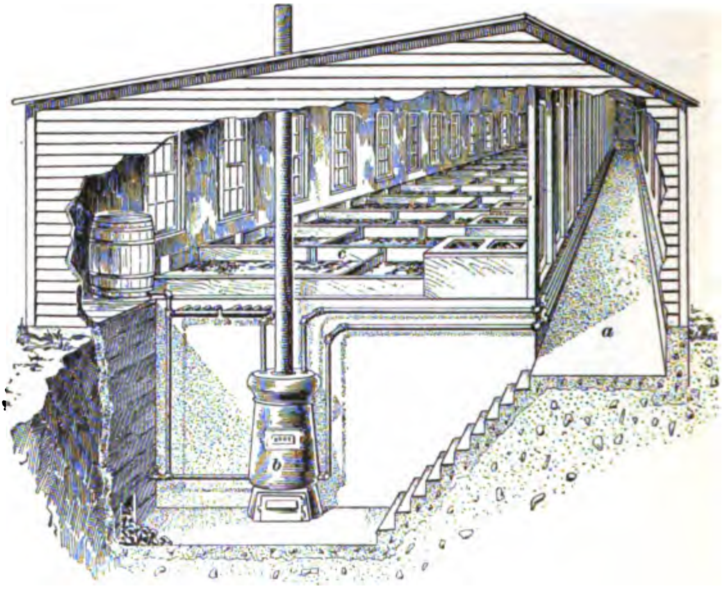


Fig. 10

When used in heated houses, only the hovers that are actually in use need be heated. When a hatch occurs, the needed hovers can be heated, and no more need be heated than the hatch demands. A brooder house that is equipped with hot-water pipes must be heated throughout whether it contains one brood or several.

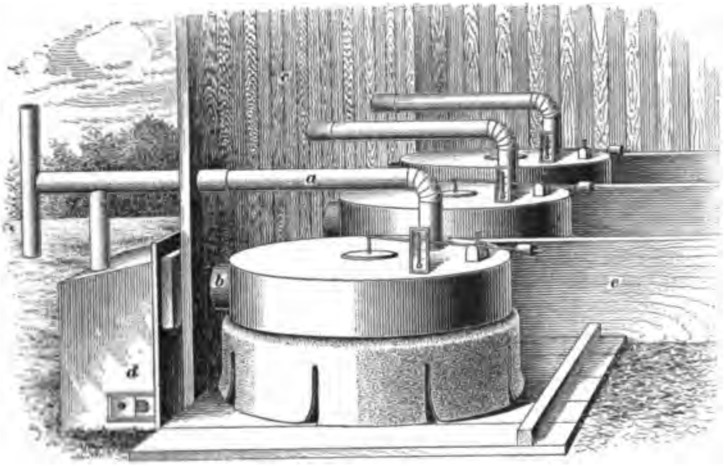


Fig. 11

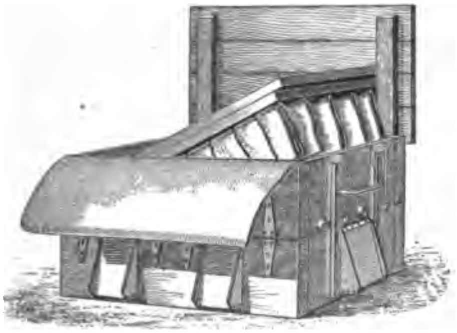


Fig. 12

12. Brooders that are built in tiers like shelves and those that have windows to all apartments are called **visible brooders.** The advantage of this arrangement is that of having the chicks continually in sight without its being necessary to open doors to see them.

13. Brooding boxes of the type shown in Fig. 12 and that can be used without artificial heat are called **fireless brooders.** Chicks in brooders of this kind are warmed by the heat from their own bodies; the linings of the box hold the heat about the chicks, thereby preventing them from suffering from the cold unless the temperature is extremely low. During cold or stormy weather, the box must be kept indoors. A box that is 24 inches square and 12 inches high can be made as shown in Fig. 13. The inside of the box must be lined with woolen cloth and woolen cloth must hang from the lids, as shown in Fig. 12. There must be small round holes *a* through both sides of the box for ventilation. The floor of the box must be covered 2 or 3 inches deep with fine-cut clover hay or chaff. It is quite difficult to have both heat and ventilation if 25 or 30 chicks are shut up in a box of this kind. They will keep warm enough to live,

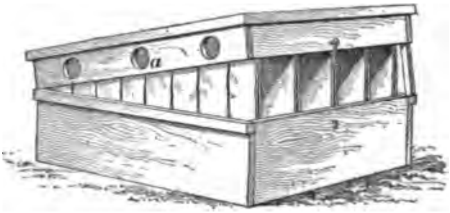


Fig. 13

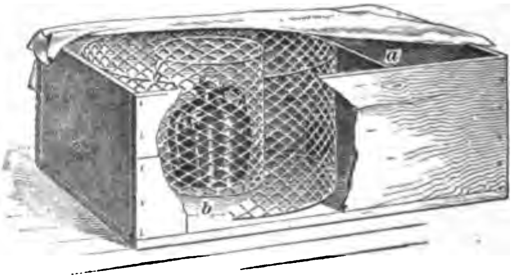


Fig. 14

but without ventilation they will die. As has been said, young chicks will not grow without warmth and fresh air, and no brooder is safe for them that does not furnish these requirements.

14. Another type of fireless brooder can be made from a box 24 inches wide, 36 inches long, and 12 or more inches deep. The box should be divided into two parts, as shown in Fig. 14. The rear part *a*, which should be 12 inches wide, is the nursery for the chicks, while the front part is the hover. The circular partitions in the hover are made of galvanized wire cloth; the outer partition prevents the chicks from crowding into the corners; the space *b* between the partitions may be used as a hover by the chicks. A stone jug filled with hot water must be placed in the center so that it will heat the brooder. The jug should be emptied and refilled every 12 hours. A brooder like this should be kept indoors and a muslin cloth should be fastened over the top during the day, thus admitting light and fresh air. When the nights are cold, the top of the box must be covered with a board, leaving space for ventilation. A brooder of this kind can be used for about twenty-five chicks until they are 2 weeks old, when they should be removed to another home.

MANAGEMENT OF BROODERS

LOCATION AND OPERATION

15. Location.—In order to have uniform heat at all times, the brooder floor should be level, therefore the brooder should rest on a surface that is as nearly level as it is possible to have it; if the brooder cannot be placed on a spot that is level, it should be placed so as to have the front side the lowest. When the brooder is placed on ground that is so uneven as to tilt the brooder, the chimney of the lamp will slant and the lamp will smoke. Outdoor brooders should be placed on fresh soil and as far from the range of old or growing fowls as is possible. Ground under cultivation is preferable to a grassy spot.

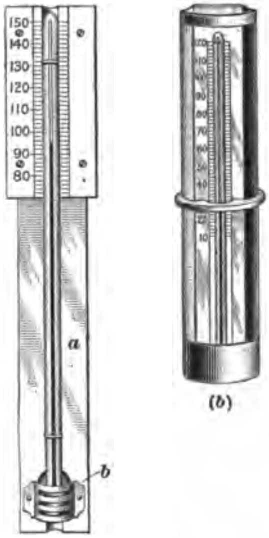
During the late spring and the summer, when the ground is dry and the weather warm, the outdoor brooders should be placed in the open. By so doing, the chicks are given conditions as nearly like those of natural brooding as is possible.

16. Proper Temperature.—Proper warmth is of prime importance in artificial brooding; if the chicks are chilled, they are of little value thereafter. If overheated, they lose vitality. The frequent occurrence of either chilling or overheating or both will destroy an entire lot of chicks. A temperature of about 105 degrees does not injure the young chicks half so much as does a temperature of 60 degrees. A chill causes indigestion, loss of appetite, and bowel trouble, from which the chick seldom or never recovers. The proper degree of heat should be maintained with absolute regularity, and there should be none but the slightest change of temperature inside the brooder. The chick needs air, sunshine, shade, and warmth. Overheating from the sun is just as dangerous as is the overheating from the lamp. Ventilation that chills the chick should be avoided; but there must be a free circulation of air inside the brooder when the sun shines on it, and the brooder must be kept closed when the weather is cold.

The temperature inside the brooder beneath the hover where the chicks go to keep warm should be 95° F., during the first 7 days. This temperature should be reduced a little each day thereafter until the temperature is 80 degrees beneath the hover. This is the correct temperature for the young chicks; if the chicks are warmer than this they suffer from the heat; if the temperature is less, the chicks are chilled and ailments result therefrom. With this temperature beneath the hover, the nursery should be about 70 degrees. The chicks come from the nursery of the incubator where the heat is about 95 degrees and at first they should have the same degree of heat in the hover.

17. Securing of Proper Temperature.—The lamp for the brooder should be large enough to hold sufficient oil for 1 day's burning. It must be strongly made of heavy metal, so that it will stand rough usage. The wick in the lamp must be long and both the wick and the lamp must be kept perfectly clean. The charred or burnt portion should be daily removed from the wick. In order to regulate the heat and thoroughly to dry out the inside of the brooder, the lamp must be lighted a day in advance of the coming of the chicks.

The directions for operating brooders recommend temperatures that range from 85 degrees to 110 degrees during the first 2 weeks. Although these records differ 25 degrees, the temperature beneath the hover should be alike in all. Brooders of different construction show different readings of temperature, because the thermometer used was placed near the heat supply or far from it, in accordance with the different methods of heating. From this it will be understood that each brooder must have a thermometer suited to its heating equipment and that no other kind will accurately register the degree of heat that is required for the brooder in use.



(a) (b)

Fig. 15

Not all brooder thermometers are alike nor are they placed in the same positions in the brooder. If a short thermometer were put in place of the one shown in Fig. 1, the temperature would be taken above the proper line. Because of this fact an incorrect idea would be obtained of the heat conditions within the brooder, which would probably be kept too cold, thus causing the chicks to crowd together to keep warm. Long thermometers as shown in Fig. 15 (*a*), are suited to some brooders, and short thermometers as shown in (*b*) are suited to others. If one thermometer is used where the other should be used, the temperature inside of the hover will not be correctly taken. Each kind of a brooder must have a thermometer that takes the temperature from a given line beneath the hover; the position of this line is given in the manufacturer's directions for operating the brooder. No rule other than the one given in those directions is safe to follow, and the thermometer to be used must be adapted to the brooder in which it is placed.

The temperature within the hover is regulated by the size of the flame of the lamp. The flame should be shaped like that of the most perfectly trimmed house lamp; that is, it should conform to the shape of the burner top—slightly higher at the center and of crescent shape. A pointed or irregular flame is liable to cause trouble. The flame of the lamp should be increased if more heat is needed and should be lowered to lessen the heat. In some brooders, automatic regulators assist in keeping an even temperature beneath the hover, but they are not absolutely to be relied on. The heat in the brooder should be regulated to conform to weather conditions. When it is cold or damp outside, more heat is needed under the hover and in the nursery than is needed when a higher temperature is at hand.

18. Preparing the Brooder for the Chicks.—Brooders that have been used for chicks must be thoroughly cleaned, inside and out, and disinfected with carbolic acid or by burning sulphur inside the nursery. A stiff brush may be used for cleaning the brooder; for disinfecting it a sulphur candle may be burned or a handful of sulphur may be thrown into a pan of live coals within the brooder. Another method of disinfection is to pour a teaspoonful of pure carbolic acid on a heated brick; fumes will rise therefrom and disinfect the brooder. No matter which method is practiced, the brooder should be kept shut for about 1 hour in order to allow the fumes to go into every corner and crevice. After fumigation or disinfection the brooder must be opened and aired. When aired, the floor inside should be covered with litter and the lamp lighted. Short-cut clover or alfalfa hay is the best litter; chaff from the barn or short-cut straw rank in the order named. The litter must be dry and free from mold or decay. Sand, earth, bran, sawdust, or shavings are not fit litter for the first week, as the chicks are liable to eat too much of these materials. After the first week, the floor of the brooder may be covered with 1 inch of dry earth or sand, and over this layer an equal depth of litter.

19. Placing of Chicks in the Brooder.—The chicks should be moved from the incubator into the brooder in the manner described in *Artificial Incubation*. About fifty of them should be placed under each hover. If necessary to do so, more than this number may be put into each brooder, but this is not best. If the chicks settle down close to the floor without crowding, it is evidence of contentment and an assurance that the temperature is correct. If their heads peep from under the edge of the curtain about the hover, the heat is comfortable for them. If the chicks stand up and open their mouths for air, the heat is too intense; if they crowd together under the hover, they are too cold and need more heat. Too much heat is better than cold because the chick will work away from the heat; when there is not sufficient heat beneath the hover, the chicks will crowd to the center and the weaker ones are smothered or forced out into the cold or are trampled to death by the stronger chicks. If the nursery is cold, the chicks gather in the corners so that they may keep warm.

20. Training of Brooder Chicks.—Young chicks must be taught to come from the hover for food and exercise and to go back for warmth. This is accomplished by removing them from the hover with the hands and by helping them back when they have finished feeding. This training must be continued until the chicks will come in response to a call and return to the hover unaided. Incubator chicks lack the natural traits possessed by hen-hatched chicks. They must be taught to eat and to protect themselves from harm, because the instincts for selecting their food and for protecting themselves from harm are lacking. They are liable to overeat, and care must be taken to prevent them from doing so. The missing instincts are usually developed within a week. After their development is complete, the chicks gain self-reliance and, like hen-hatched chicks, are able to care for themselves.

During the first 4 days the chicks do best when they are confined within a limited space. A narrow board set across the nursery will hold them close to the hover and they should be confined in the nursery for the first 7 days. After the first week's growth, their strength should permit of active exercise in the scratch room next to the nursery. During cold weather, the chicks should be confined to the brooder for a month at least, before they are allowed to go out on the ground. When the weather is warm, the chicks can go out as soon as they have been trained to return to the hover for warmth. When first they go out on the ground they should be closely watched, and if they show the slightest indication of becoming chilled they must be returned to the brooder. Training of this kind will teach the chicks to seek the shelter of the hover before they are chilled.

Brooder chicks are called in many ways. The striking of an iron spoon on a tin pan is the usual call at feeding time. The rattling of small stones against the side of a tin cup, or the sound made by striking a board with a stick or spoon may also be made a signal for feeding. The sounds made by scraping a thin piece of wood against wire netting or the shaking of grain inside of a tin bucket bring ready response, provided these sounds are made only as a signal at feeding time and for no other purpose. When the chicks are taught that in answer to a certain sound they will be fed, either inside the brooder or close to it, they will come quickly in answer to the call. If the call is made and no feed is given to them when they come to the brooder, they will become careless of the call or indifferent to it, and will fail to come in answer.

The power of resistance and the instinct to run from danger come to the brooder chicks as the result of care and training, and they are hardened by the gradual reduction of temperature inside the brooder. The advantage of the hardening is seen when the time arrives for them to go outdoors, for hardened chicks are able to withstand the outside temperature and weather changes. This gradual hardening is beneficial to the general health of the chicks, as it strengthens their muscles and excites the activity of the digestive organs. When the chicks learn to scratch for food, the exercise obtained therefrom invigorates them and thus enables them to care for themselves.

21. Care of Brooder.—Fresh air and sunshine are absolute necessities for the welfare of the chicks. Weather permitting, the brooder should be opened and aired each day, and sunshine should be admitted frequently. The top, doors, and windows of the brooder may be opened and closed to regulate ventilation. If the sun shines directly on the brooder for any length of time, it must be protected by shade to avoid overheating inside. During warm weather outdoor brooders should be placed beneath trees for shade. The brooders must not be too tightly closed at night or at any other time; a reasonable amount of air must be admitted to the chicks at all times. Less air is needed during cold weather than when the weather is warm. The needs of the chicks should be studied, as should also the regulation of the brooder, in order that chicks may have the right heat, light, and air.

22. Cleanliness in the brooder is of as much importance as the feeding of brooder chicks. There is but little danger of ailments and almost full assurance of success if the brooders are kept in a sanitary condition. Brooder chicks cannot stand the bad influence of unsanitary surroundings. Lack of cleanliness, or the presence of hens or sparrows in or about the brooder, brings lice to the chicks. When lice become established in a brooder, they soon become a pestilence. Earth gathered from places where germs exist and used as litter brings disease. Hen cholera is sometimes introduced in this manner. A system of sanitation should be established and strictly adhered to, wherever chicks are grown; whether the method used is natural or artificial makes no difference.

Success cannot result from an attempt to grow chicks where dirt or filth abounds.

The brooder must be cleaned each week, or more frequently if the litter becomes foul. In cleaning the floor, the litter under the hover should be swept into the nursery. Then the nursery and exercising room should be thoroughly swept, and when the floors have been cleaned they may be covered with fresh litter. Dust may fly from any earth litter that is used on the brooder floor; if the dust closes the gauge of the lamp, the use of earth or sand must be discontinued, otherwise the dust may cause the lamp to smoke and to take fire. All sweepings from the brooder should be thrown where the old fowls can work it over for the food it contains.

Brooders of all kinds are quickly cared for when they are under shelter, where the lamps can be cleaned and refilled without the annoyance of inclement weather. When the wind is blowing or rain is falling, it is difficult to refill the lamps or to light them unless they are protected by a shelter. The troubles of caring for the brooder and chicks out in the open, when the weather is bad, exceed those of the care of hens and chicks under like conditions. When the brooders are out in the open, the lamps may be taken inside for refilling.

23. Frequently an entire brood of chicks is destroyed by dampness, while the attendant remains in ignorance of the cause of death. As dampness inside the nursery is a menace to health, water spilled on the brooder floor is most dangerous to the chicks, provided there is enough of it to keep the litter wet. Continued dampness will also result from the leaking of defective fountains.

Water scattered or tramped into the litter by the chicks makes dampness prevalent throughout the brooder. Litter that is damp softens the droppings that are mixed with it and the entire mass becomes moldy. In this condition the mass is a poisonous receptacle for food. Food thrown into or near litter that is so contaminated is poisoned by the mold, and the chicks that eat this food may have indigestion, bowel trouble, or enteritis. Dampness may also be caused by weather conditions; the ground under the brooder may be wet or water may flow against the brooder and settle about it. Dampness from any cause may be destructive to a brood. Chicks inside of a brooder that is dry and clean will prosper, although the ground outside may be wet.

24. Effect of Changes in Food and Conditions.—Exposure of the chicks to weather changes must be avoided as far as possible. If the weather turns cold, the heat inside of the brooder must be increased; if the weather becomes warmer, less heat will do. Other changes are frequently more injurious than are weather changes. An absolute change of diet may harm the chicks, and if the change is abrupt it is certain to be harmful to them. A change from wet feed to dry feed, or an excess of laxative foods following the eating of foods that are condensed will cause bowel trouble. A plentiful supply of greens following none at all is another cause of indigestion or bowel trouble. A sudden removal from the protection of a shed or shelter to the open may *wilt*, or destroy, the entire brood; this effect results from the direct rays of the sun shining hot on them. Sudden changes of all kinds should be avoided; they shock the system and cause troubles innumerable.

25. The Brooding of Incubator Chicks by Hens.—It frequently occurs that hens are used to brood incubator chicks, but to be successful in this practice, the chicks should be placed in the nest under the hen the evening before she is removed to the brood coop; otherwise the chicks will not understand the call of the hen and they may be chilled for lack of knowledge of the place to go to for warmth. Incubator chicks must be taught the ways of the mother hen or they will not understand her call at feeding time, nor will they return to her after they have fed. Many failures result from ignorance of the fact that incubator-hatched chicks must be taught the ways of the mother hen.

26. Comparison of Brooders and Hens in the Rearing of Chicks.—There are ailments that come more frequently to chicks in brooders than to those with hens. These ailments are occasioned by the removal of the chicks from natural conditions and the failure to supply them with the best artificial conditions obtainable inside of the brooder. Weakness of the legs, contraction of the muscles, crooked toes, and vertigo are among the ailments most prevalent. They result from overheating, from chilling, or from eating unwholesome food. Slipping on smooth places may bend the legs of young chicks. Overheating will cause them to suffer and too much heat under the floor will shrivel the flesh on their shanks and feet. None of these troubles will occur in broods that are raised in an environment that is reasonably good. The figures given in Table I show the possibilities of artificial brooding. The 2-week test was made with chicks part of which had been hatched by hens and part by incubators. The chicks used in the 4-week test were all incubator chicks. In both tests 12 or 15 chicks were brooded by each hen, and there were over 50 chicks in each brooder.

TABLE I

RELATIVE EFFICIENCY OF NATURAL AND ARTIFICIAL BROODING

Test	Artificial Brooding			Natural Brooding		
	Number Chicks Brooded	Number Chicks Dead at End of Period	Per Cent. Dead	Number Chicks Brooded	Number Chicks Dead at End of Period	Per Cent. Dead
Two-week test......	107	25	23.3	151	38	25.0
Four-week test.....	110	13	11.8	103	27	26.2

These results were obtained from tests most carefully made and are favorable to artificial brooding, but the results are not conclusive evidence that artificial brooding excels natural brooding under all conditions. Although fully as many chicks can be grown to maturity with artificial brooding as with natural brooding, these results are only obtainable from excellent management. Inexperience or neglect will cause failure.

FEEDING CHICKS IN THE BROODER

27. The methods of feeding chicks are fully explained in *Poultry Feeding*, Parts 1 and 2, yet it is necessary that some special directions be given concerning the feeding of brooder chicks, because they are closely confined and are compelled to live by their own efforts. All that they eat must be selected for them; they are untaught in the selection of bugs and insects for food. The knowledge of the chicks is confined to what the attendant teaches them. As soon as they are able to scratch, the securing of food must be made a means of exercise. Small particles of grain must be thrown into dry litter, thus inducing them to exercise in search for food. They should be fed frequently in this way—a little at a time to keep them busy.

During the first few days of their existence, the chicks must be taught to eat grain and to care for themselves in a brooder. Their first food should be grit or sand; this food should be scattered among them and they must be coaxed to pick the grit and eat it. There is no cluck to the brooder, and the senses of hearing and feeling must be quickened into action, for by these senses the chicks are guided. They must be pushed about a few at a time with the hands, and in this same way they should be moved out from under the hover to feed. Then they should be coaxed back in the same manner when they have finished feeding. Within 2 hours they must come out again. At this time some rolled oats should be sprinkled among them in the grit, and this method of feeding them should be practiced at every meal during the first 2 days. A mixture made of equal amounts of rolled oats and bread crumbs should be fed to them after the second meal of oats—about a teaspoonful to each lot of chicks; as they eat it up more should be given to them. After the chicks have been handled and fed in this way for 2 or 3 days they will become accustomed to caring for themselves.

For the first week, the larger portion of all food fed to the chicks should consist of crumbs of bread and fine particles of oatmeal, wheat, and corn. The smaller the grains, the better they will be for the chicks; large pieces of grain should not be fed to them, neither should they have dry meal or wet feed. Bread soaked in milk and squeezed dry can be fed to them. Bread crumbs and oatmeal mixed with cooked potato is also good for the chicks. Rice boiled in milk and mixed with bread crumbs and oatmeal, and mixed into a crumbly mass is good food occasionally.

After the first week, the chicks must have meat of some kind. Granulated meat or cut green bone is especially good for them. Meat will cause indigestion and bowel trouble if too much is given, therefore they should have just a small amount at first; than a little more, until each chick has about a thimbleful daily. Grit, granulated bone, and charcoal should always be kept where the chicks can help themselves. Phosphate of lime is needed for bone and feather growing, and this they must gather from the food that they eat. An ample supply of phosphate of lime is most readily obtained from grit and bone.

When the floor of the brooder is littered with short-cut clover or alfalfa hay, no other green food is necessary, but fresh greens are always acceptable and beneficial to the chicks. Fresh grown grass, green rye, or any other growing plant that is fit for the chicks to eat can be fed to them, provided it is cut into very small bits. Long pieces of grass will clog the crop; chicks are sometimes killed by grass or other food that clog the passage from the crop to the gizzard. Hulls or chaff from oats, long pieces of hay or straw, chips, and sawdust also close this passage if they are plentifully eaten by the chicks. When the brooder chicks are 7 days or more old they may be fed as directed in *Poultry Feeding*, Part 2.

28. Drink for Brooder Chicks.—Water should be placed close to the place at which the chicks are fed, but not so close that the chicks get into it when eating. They should be permitted to drink at will, but not forced to drink, nor should they be compelled to walk into the water or through it when eating. Warm milk fresh from the cow is most beneficial as a drink. Milk should be given to the chicks in a clean cup or tin.

An improved milk cup for young chicks is shown in Fig. 16. Such cups are easy of access and they shield the milk from dirt. Water fountains of small size are best for use inside the brooder. Ice-cold water should not be given to the chicks; the chill should be removed from the water before it is given to them

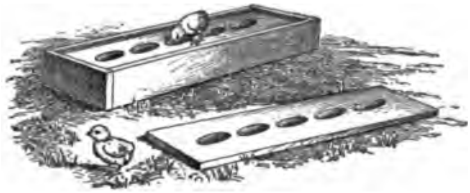


FIG. 16

MANAGEMENT DURING WEANING PERIOD

29. A gradual weaning away from heat is best for brooder chicks. This process should begin when the chicks are 4 weeks old, and from that time until the end of the seventh week the temperature should be lowered a little each week until the heat under the hover has been reduced to 70 degrees. Chicks must be fairly well feathered before they can be deprived of heat at night. The Mediterranean breeds are well feathered when they are 8 weeks old; the American breeds are usually covered with feathers when they are 10 weeks old. Asiatic breeds frequently require even more time to feather. Chicks that are covered with feathers can be moved into colony coops to roost as soon as the night temperature does not fall below 60 degrees, but as long as the nights are cooler than this the chicks should stay in the brooder and should have a little artificial heat to keep them warm. This practice should be continued until the chicks have been hardened and thus enabled to withstand night temperatures without heat.

Chicks are apt to crowd together for a night or two after they are first deprived of heat. This crowding may result in a crush that will kill some of them, but it can be avoided by placing roosts for the chicks inside of the coops. They must be taught to go upon the roosts. This is accomplished either by lifting them upon the roost or by having them follow older chicks that know the way.

30. Size of Flocks.—Not more than 100 growing chicks should roost together in one lot; a smaller number than this is preferable. As far as it is possible to have them do so, chicks of the same size and age should roost together. Chicks 5 weeks old fare badly with those that are double their age; as the old ones trample on the young ones, prevent them from eating, and crowd them during the night. Moreover, flocks that are of uniform age, size, and color have an attractiveness that is advantageous at selling time. When uniform in size, chicks grow faster than do the small ones in a flock composed of large, medium, and small-sized chicks. The fact that chicks can be taught to eat near their own colony house and to roost within it has made possible the keeping of many colonies in an open field without the use of fences to separate the colonies. Large numbers of chicks that are kept together yet separated into colonies can be cared for more economically than fewer chicks kept in smaller flocks. Separating the sexes gives the chicks a better opportunity to grow, and in

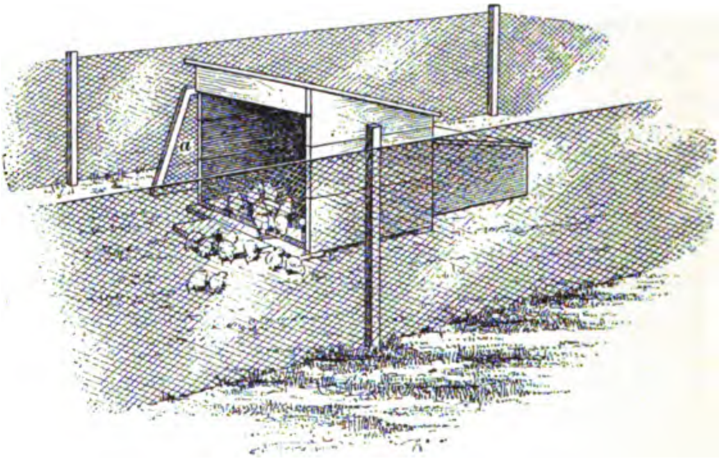


Fig. 17

some instances this separation can be made when the youngsters are moved from the brooder to the colony house.

31. Sheltering of the Chicks From the Sun.—Young brooder chicks may be sheltered from the sun and rain by a box coop like that shown in Fig. 17. The coop can be placed in front of the brooder, at one side of it, or in its rear; in fact, it can be placed in any position that will allow the chicks to pass from the brooder into the shelter and back again. When the chicks have been taught the way to the brooder, the screen front *a* can be removed so that the chicks may run at will on the ground. If made large enough, the brooder can be used as a colony coop for the chicks after they have been weaned from the heat of the lamp. When used as a roosting coop, poles must be placed inside for the chicks. Coops like this can be made from store boxes at very small cost. In order to remove the danger of harboring insect vermin, such coops may be burned as stove wood in the fall, after their use has been discontinued.

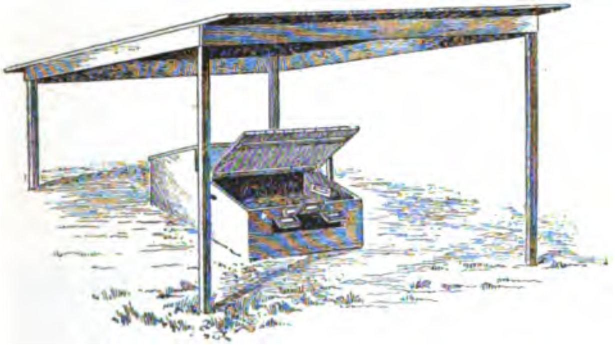


FIG. 18

A portable frame shelter like that shown in Fig. 18 is a convenient appliance. Brooders with chicks can be placed beneath its roof, and such shelters can be set up in any locality where shade is needed for the chicks. When the shelters are built in the open, they must be fastened into the ground, to prevent strong winds from blowing them away. Similar shelters can be built in the corners of close board fences and made to serve as a night shelter for the chicks during hot weather. An inexpensive box coop shelter can also be made like the one shown in Fig. 19. Such a shelter serves as a colony coop, into which a brooder can be placed during the early spring; later, the brooder may be removed, and the coop as shown will answer for a roosting coop. A coop like this can be moved to any locality where the chicks can range, and is specially adapted for use in orchards or corn fields.

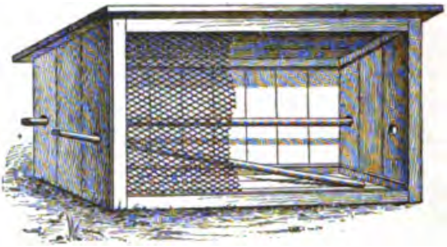


FIG. 19

No other place for ranging excels woodland or orchards adjacent to an open field. Protection from sun, rain, and wind is afforded by the trees; sunshine, grass, and animal food will be found on the open field. Cockerels and pullets in separated flocks will grow rapidly under the healthful influences of such environment.

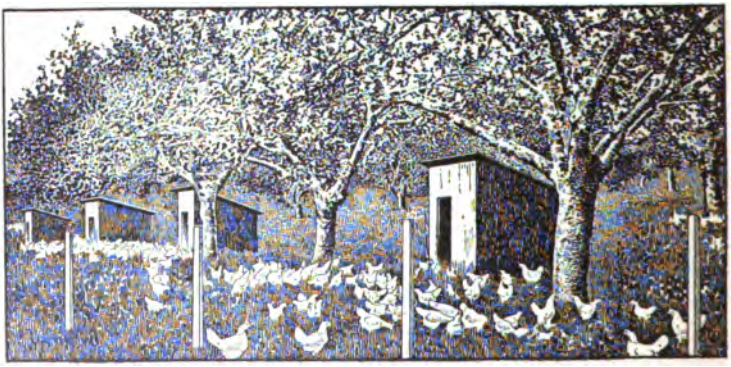


FIG. 20

Colony coops are located to advantage when they are placed under the trees in an orchard. If the orchard borders on an open field, as shown in Fig. 20, or on a field planted with corn, there will be an ideal location for the young stock. When the field adjoining the orchard has been planted with grain, a wire fence can be built along the line between the orchard and field, and the fence will keep the chicks within the orchard, thus preventing them from scratching up the seed or the young plants. The fence can be removed or an opening made through it, as soon as the plants in the field have grown beyond the danger of being injured by the growing chicks.

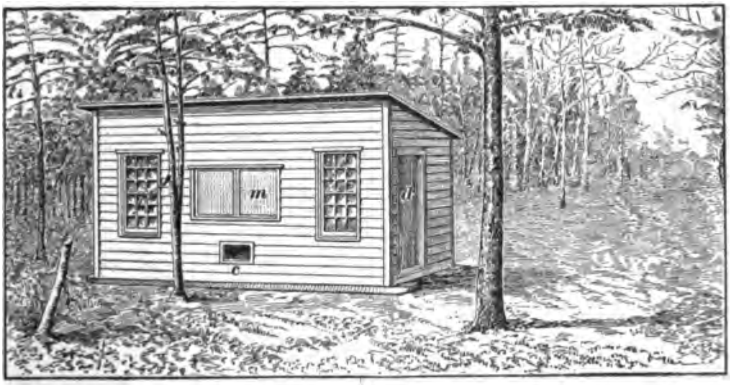


Fig. 21

Land that has been overgrown with small timber and underbrush also makes an ideal range for young fowls. Colony houses like the house shown in Fig. 21 can be built among the trees. The house shown is 12 feet wide and 24 feet long. Runners made of plank are laid flat on the ground under the sill and lengthwise of the house. Board floors in this house will not be needed, unless it is necessary to protect the chicks from animals that burrow to get into the house. The house should be kept under the shade of the trees during the period of hot weather and should be moved out into the clearing during cool or cold weather.

The center opening *m* in the front of the house should be 3 ft. × 6 ft., and should be closed with two frames covered with muslin. The outside of all the windows should be covered with wire cloth. An opening *c* for the fowls to go through can be cut in the front of the house, or the entrance door *d* can be left open during the day and be closed at night.

32. Feed During the Weaning Period.—During the weaning period and thereafter, hoppers may be extensively used in the feeding of brooder chicks. In their use, the hoppers may be filled with either whole or cracked corn or other grain, and they should be fastened to the inner side of the door of each colony house in which the growing chicks roost. From these hoppers the chicks can help themselves at night after the door has been closed to shut them in, and in the morning before the door is opened; also at will during the day. Hoppers filled with dry mash and beef scrap can be hung against the wall inside of the house; while this practice is not an absolute necessity for chicks that have free range, its use hastens their growth. This system of feeding forces growth to a surprising extent. The value of this method should not be overlooked, for by its use chicks can be grown to market size in about one-third less time than would be taken if they were fed entirely by hand at stated intervals. Hoppers may be used for holding a constant supply of grit, granulated bone, and charcoal. Hopper feeding is the most economical way of feeding, especially when the hoppers are made so as to avoid a waste of their contents, and when they are kept constantly filled. If the hoppers overflow when the chicks pick food from them, their use will be wasteful and expensive.

Feeding the chicks by hand cannot be discontinued even though the hopper feeding has been begun. Other kinds of grain not included in the mixture fed in the hoppers, must be scattered on the ground for the chicks to pick up. By so doing the chicks will be induced to eat more frequently than they otherwise would, and the more they can be induced to eat, the larger and faster will they grow, provided the food they eat is of a kind that promotes growth.

The time and expense involved makes frequent feeding of large flocks almost prohibitive, yet in no other way can the chicks be forced to grow so fast. From the hoppers they will eat the corn, dry mash, and meat scrap at will. If, in addition to this, they are fed wet mash at noon and dry grain in the morning and evening, they can be induced to eat more and grow to a larger size in a much shorter time than when more sparingly fed.

33. **Dangers During Weaning Period.**—Cold, wet nights frequently follow hot, sultry days. Under these conditions the chicks are warmed almost to a fever heat when they go to roost, and immediately after they may be chilled by the cold, especially if the wind blows directly on them when in their heated condition. Such exposure is liable to cause catarrhal troubles in the eyes, nose, and throat. The plumage of the chicks sometimes becomes water-soaked with rain. If they now go to roost in overheated, poorly ventilated quarters, not sufficiently large to furnish a comfortable roosting place, the evaporation of the moisture of their feathers will poison the air, and malaria may be developed. Roosting at night in unventilated houses or coops, or changing from a well-ventilated to a poorly ventilated coop, will undermine vitality. Shocks result from going from a warm roosting room into an atmosphere that is cold and damp, and catarrhal troubles or roup may result therefrom. Chicks contract colds or roup from an atmosphere laden with malaria, and from crowding into houses that lack ventilation. Nothing is worse than a lack of ventilation in the rapid creation of catarrhal colds. The dangers mentioned are the prime causes of infectious diseases among chicks.

34. The scourge of **insect vermin** frequently comes with unrelenting force. The accepted theory that lice never trouble incubator chicks is misleading, for notwithstanding the fact that chicks come from the incubator free from these parasites, they are often acquired very soon thereafter. It is true that incubator chicks are not afflicted with lice from clean brooders, but lice may be brought to the chicks,

provided hens or sparrows come near; thus the chicks may become infested with lice as soon as they leave the brooder. Unfounded assurance coming from wrong impressions leads to neglect, and the attendant frequently fails to look for insect vermin. He does not imagine the possibility of their coming until the chicks are so infested with lice that their eradication is almost impossible. The sooner a lice-infested brooder is thoroughly saturated with a liquid that will destroy the lice, the quicker will relief from the scourge be had. The chicks must then be removed from the brooder, and after they have been thoroughly dusted with insect powder, they can go into another brooder. The infested one will not be fit for use until it is absolutely free from vermin.

35. The foregoing dangers excepted, no other danger equals that of **ptomaine poisoning,** which is frequently caused by the consumption of putrid meat, decayed food of any kind, or food that is in the process of decay. The organs of digestion may also become paralyzed as a result of eating moldy grain; moldy bread is equally dangerous. Fowls or chicks will be poisoned from eating the decayed flesh of dead animals, or that of fowls or chicks that are left where they die. Decayed or moldy grain that sprouts in damp places or under boards or coops is also a menace to the health of chicks. Bran, middlings, or meals of any kind are poisonous when moldy. Grain that has been scorched or partly destroyed by fire, sometimes contains poisonous material that will cause the chicks to die. All ailments that result from the above causes can be prevented by the careful application of the principles of feeding, good ventilation, and cleanliness.

36. Chicks that are kept in close quarters or on a limited space will not digest their food so readily as do chicks that have the freedom of the fields. Where chicks are kept in a small enclosure, the ground soon becomes tainted. This thing is especially apt to occur during the hot summer weather, or after the same ground has been used for a considerable length of time. When strict attention is given to

their wants, chicks will grow fast on a limited space. To secure this result requires that all their food shall be digestible, and shall not be mixed with useless hulls. The rations of the chicks must be carefully selected from growth-producing grains; they must have a full supply of meat and green food, and their quarters must be kept scrupulously clean. The cost of growing chicks in this way diminishes the profit obtainable from them as market poultry, yet this method will produce poultry and eggs for the family table at a price much less than that paid in the open market for the product.

37. Chicks grow slowly in hot weather. The enervating effects of heat and a constant search for insects on the range prevent the formation of much meat on the skeleton. Shade must be provided where none exists, and a more liberal supply of meat and green food must be fed when a natural supply is lacking. Pure, fresh water must be supplied in abundance, and special attention must be given to the ventilation and cleanliness of coops. The hot rays of the summer sun will burn the flesh of chicks that are not fully feathered. This causes them pain and retards the growth of feathers. Relief from this can be had only on a run that is shaded and cool. If chicks are protected and are fed bone meal in their mash, their feathers will come more quickly.

MANAGEMENT OF THE BROODS AFTER WEANING

SUMMER BROILERS

38. The same general system of feeding, culling, and sending to market that is used for hen-hatched chicks should be observed in handling brooder chicks. There is no material difference between the two kinds of chicks, and after the chicks have been removed from the brooder to the range, the brooder chicks cannot be distinguished from the hen-hatched ones, if all are of the same age and variety, and are equally well grown.

39. Chicks that are intended for use as summer broilers should be grown during the summer months on stubble fields where waste grain and insect life abound; for under such environment they will thrive and grow quickly into sizes best suited for the summer broiler trade. When grown under such conditions, the cost will be lessened; and if they are sold as soon as they are full feathered and weigh 2 pounds each, they can be disposed of at a profit. The secret of success in growing summer broilers by this method is to have them hatched in time to grow large enough to be able to range freely over the fields as soon as the grain has been cut. If the chicks are well grown, they should be able to do this at 4 weeks of age. Broilers that are grown in this way should be fed all they will eat, in addition to what they find on the range, and their roosting places must shelter them from the elements without depriving them of a plentiful supply of fresh air. The prime causes of loss in growing summer broilers are neglect in the housing and feeding of them for speedy growth, and in not selling the broilers as soon as they are ready for market.

40. Feeding of Summer Broilers.—The method of feeding summer broilers in the fields differs materially from that of feeding pullets for laying. Summer broilers are grown for the one purpose only, and they must be fed for speedy growth and not for the development of vigor. Where there is a plentiful supply of insect life on the range, the chicks can be fed a wide, or fattening, ration; if but little insect life is there, a balanced ration must be fed. When the chicks are 10 weeks old they should average 1½ pounds each and they should then be ready for fattening for market. When they are fattened properly, an additional 8 or 10 ounces of meat and fat will be added to the body in about 2 weeks. To accomplish this, the chicks must be kept inside of yards or runways during the last feeding stage. During these 2 weeks they must be fed heavily with rich foods that will fatten them quickly.

When the broilers are fattened in this way, they should be fed once a day all the cracked corn and wheat they will eat up clean. The rest of their feed should be in the form of a mash. Half of the mash can be made of ground oats or barley, one-fourth of corn meal, one-eighth of wheat bran, and one-eighth of beef scraps, the whole mass mixed and moistened with milk. All the husks should be removed from the oats and barley meal. The broilers should be fed all they will eat of this mixture three times a day. None of it should be left for them to nibble at between meals. Just as much as they will eat up clean, and no more, should be fed to them each time. If any of the mash is left after they have finished eating, it should be gathered up, and if it is clean and sweet, it can be cooked and mixed with the next lot of mash. Grit and pieces of broken charcoal should be kept where the chicks can help themselves at will. When a ration too rich for the chicks has been fed to them, it is apt to throw them off their feed; when this occurs, the quantities of ground oats and bran in the ration should be increased and those of corn meal and meat lessened. The broilers will finish off more delicate and tender if they are given no water during the last 2 weeks.

41. Housing of Summer Broilers.—Colony houses that are placed on the west side of an open field are most satisfactorily located for the sheltering of summer broilers. If possible, the houses should be close to trees that will shelter them from storms and that will furnish ample shade from the afternoon sun. A desirable location is shown in Fig. 22. The houses, having been placed near the edge of a wheat stubble field, will be sheltered from sun and storms by the trees in the rear. Naturally, the fences would not be built in the fields; but movable fences can be placed about the houses where fences are needed to keep the broilers from wandering over the fields. When restrained from taking violent exercise, there will be less hardening of the muscles, and the flesh of the birds will become soft and tender. The less exercise they have during the last 2 weeks, the more tender the meat will be. When handled in this way, the broiler grows quickly and its frame is well covered with lean meat and fat.

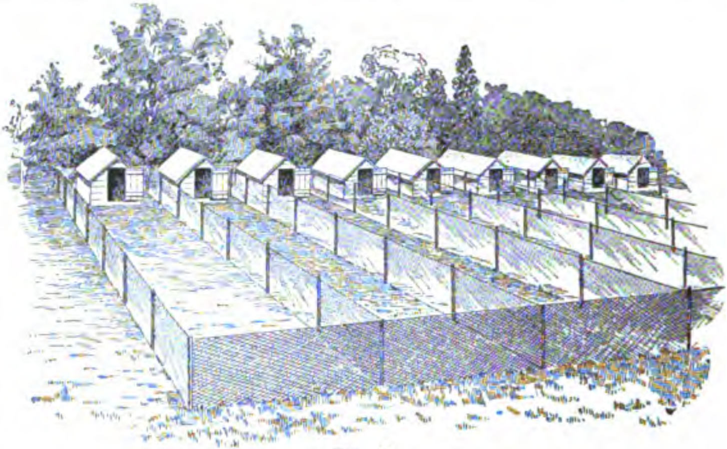


FIG. 22

FEEDING OF SURPLUS COCKERELS

42. When a number of half-grown cockerels run together or with other poultry, they are apt to disturb the entire flock and prevent it from growing as it should. When such is the case, the cockerels themselves will be inferior as table poultry. The surplus cockerels should be shut up in coops and should be fed for the production of palatable table meat. Coops or crates like those shown in Fig. 23 may be used to hold the cockerels while they are being fed into prime condition. Such coops should be supported on legs and should have slat bottoms. They should be placed where they will not be in the way; the best results will be secured if they are placed in a basement or in an outbuilding that is cool and that can be darkened. Cockerels can be fed into a good quality of table meat in 2 weeks in this way. The fowls inside of the

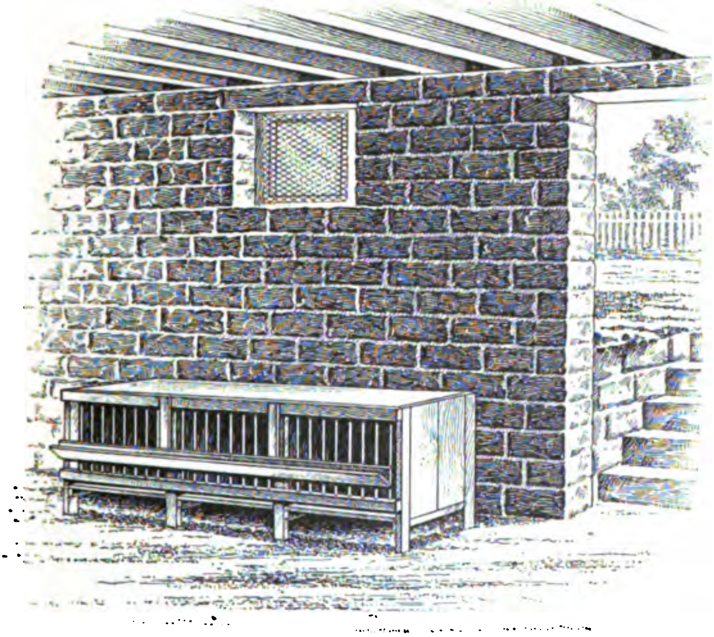


Fig. 23

coops will be quiet while roosting on the slats, which also permit the droppings to fall through into dry earth below. The dry earth under the coops acts as a deodorizer, and should be at least 3 inches deep.

Poultry of all kinds and ages can be fattened in coops. A more complete explanation of this method of fattening fowls will be found in *Market Poultry.*

IDENTIFICATION MARKS

43. As has been stated, permanent advantages follow the careful selection of the most prolific egg-producing hens to build up the flock and to perpetuate their kind. And although all the pullets of a hen that has laid more eggs in a year than any other in the flock may not be as prolific as their mother, they can be depended on to a greater certainty to produce prolific layers than a family that comes from less productive stock. A system of selection by which the very best laying hens and pullets are kept to produce the eggs for hatching should be established. In the production of market poultry, a like system should be applied in the selection of specimens best suited for establishing a line of breeders that will produce the best quality of table poultry. In both cases, the use of identification marks of some kind is a necessity.

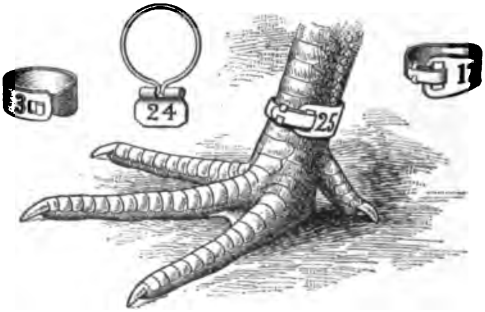


FIG. 24

44. Rings, or **bands,** as shown in Fig. 24, can be fastened about the shanks to mark the chicks for future identification. Pieces of wire can also be made to serve this purpose by fastening them about the shank. Marks of this kind are, however, apt to be pulled loose, and when they are gone the identity of the fowl has gone with them. Holes cut through the web of the foot of young chicks soon after they are hatched form marks of identification that can be neither lost nor removed. Punches specially made for the purpose should be used for cutting the holes. When in use, the base of the punch should rest on the forefinger of the right hand, the thumb resting on the top of the plunger, the punch being held between the two, as shown in Fig. 25. When the mark is made, the foot of the chick must be placed on the base of the punch with the web of the foot beneath the point of the cutter. The plunger must be forced down by the thumb so that the cutter will puncture a hole through the web of the foot between the toes. Care must be taken to remove the severed portion from the hole to prevent its growing together. The wound will heal in a few days and a small round hole is left in the web.

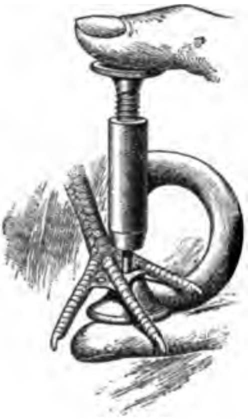


Fig. 25

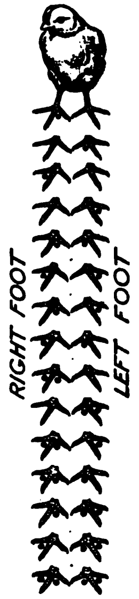


Fig. 26

45. A **system of toe markings** is shown in Fig. 26. Fifteen different markings can be made with a punch through the web of the foot. A single hole through the inside web of the right foot can be registered as mark one; a like mark in the left foot will be number two. The combinations possible are shown in the illustration. By the use of these identification marks the keeping of records is simplified. The importance of the use of records is fully explained in

Laying Hens. In anticipation of these records, the chicks that are hatched from the selected eggs are toe-marked or otherwise identified to save them from going to the shambles as broilers or as other kinds of market poultry. In building up a strain of good layers, the beginning should be made by marking chicks from the most prolific layers. The same principle is applied in the establishment of a good strain of market poultry. These markings should be used on the progeny of selected stock only and will serve as a guide for the selection of the pullets that should be saved for winter layers. Those that have toe markings should be kept, no matter what their appearance may be, for in this way only can a good start be made.

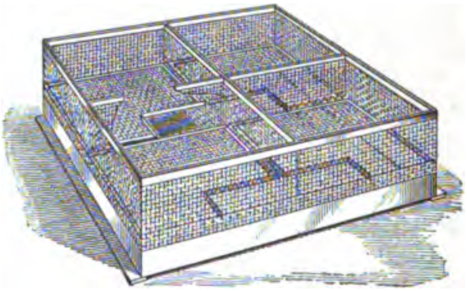


Fig. 27

46. Records can be kept quite as readily with chicks artificially hatched as with hen-hatched chicks. The partitioned egg tray shown in Fig. 27 can be used for holding the eggs from selected hens. The eggs must be marked with numbers before they are placed in the incubator for hatching. On the eighteenth day of incubation, the numbered eggs must be transferred from the regular egg tray into the special tray. When hatched in this tray, the chicks cannot get out of it. After they have been marked, the chicks may be placed in a brooder with other chicks with no danger of their identity becoming lost. Separated trays can be used in any incubator. Partitions can be made of tin or wood, and they can be placed in the egg trays to separate the eggs as well as the chicks when they are hatched. When they are used, the unmarked chicks must not be allowed to drop into the nursery; if this is permitted, their identity will be lost. Divided egg trays and nurseries to match can be made to fit all kinds of incubators. When they are used, the chicks from the selected eggs will fall into that part of the nursery that has been prepared for them. To keep a correct record of chicks hatched by hens, each hen should have eggs from only one hen given her for hatching.

LAYING HENS

INTRODUCTION

CLASSIFICATION

1. Hens and Pullets.—Although it is not unusual for young hens to be called **pullets** until the close of their first laying year, which ends as molt begins, strictly speaking the term pullet should be applied to female fowls that are not more than 12 months old. In the same way the expression **yearling hen** should be used only in speaking of hens that are more than 1 year old and less than 2. After the hens are more than 2 years old, and frequently as soon as their second molt has passed, they are known as **old hens.**

Early hatched pullets, provided they are grown rapidly, lay a greater number of eggs during their first egg-laying period than in any other. Although late hatched pullets frequently lay more eggs between the first and second molts than they do prior to the first molt, it is generally true that poorly grown pullets or pullets that from any cause have failed to lay as well as they should during the first winter, seldom if ever lay well at any time, except during the spring and early summer, and then only when conditions are favorable. On the other hand, those that are prolific egg producers during their first egg-laying period, continue to lay well throughout their second year, provided that they have molted properly and come from vigorous stock. Hens that fail to lay well during the second year are not profitable unless they have valuable qualities other than those of egg

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laying. It should always be remembered that hens and pullets that are bred for egg laying produce more eggs than *mongrel fowls.*

2. **Mongrel Fowls.**—The barn-yard, or barn-door, fowls of our fathers are more accurately described by the term **mongrel,** which means of mixed breed or origin, and even today most of the farm poultry flocks in the United States are composed of mongrels. These flocks in many cases are kept at a loss, the loss being due to no other cause than the poor egg-laying ability of the mongrel. These unprofitable farm flocks are too often the result of selecting the best individuals for the market or for table use and of using the less desirable members to replenish the flock. Mongrel fowls for market poultry are also much inferior to the pure bred ones, because individuals of the latter class are larger and plumper than the mongrels. Again, the mongrel lays few eggs, and these few are laid at the time of year in which eggs are cheapest. In many cases the keeping of mongrel flocks has created throughout large areas a prejudice against all kinds of poultry. Mongrel flocks of hens may well be likened to neglected orchards of wild, or natural, fruit; neither such flocks nor such orchards have a place on the land of the progressive farmer.

3. **Breed.**—By a **breed** is meant a certain kind or group of individuals that have in a marked degree the power of transmitting to their offspring characteristics that have been artificially developed. Each breed should have well-defined characteristics. Breeds of poultry should be distinguished from one another by differences in body shape, including differences in comb and other head appendages. Body formation, or type, should be so distinct in each breed as to separate it from other breeds without regard to plumage color. Plumage color is one of the distinguishing features by which each breed is separated or divided into varieties. For example, the Plymouth Rock is a breed of poultry, and the offspring of pure-bred Plymouth Rocks should have all the characteristics of the breed. This breed is made up of several varieties,

each being distinguished by its plumage color; barred Plymouth Rocks and white Plymouth Rocks are two distinct varieties of this breed.

There is, of course, more difference between two breeds than between two varieties of the same breed, although to a novice this fact may not always be apparent, because the item of color upon which the amateur is likely to base his classification is frequently of small importance in distinguishing one breed from another. To the tyro in the poultry business, white Plymouth Rocks and white Wyandottes appear nearly identical. There are, however, many differences between the body types of the two breeds. The matter of selecting a breed is one of importance. A breed that lacks the desirable quality of prolific egg production or that fails as market poultry should not be selected for the farm or for use in crossing with mongrels with the expectation of increasing their value. Even in the best breeds, not all individuals produce profit, and in spite of careful selection some drones are likely to be present in every flock.

4. Separate varieties of each breed should possess all the characteristics of the breed; the varieties often differ from each other mainly in the degree to which the characteristics are developed. The varieties of a breed should not be mixed with one another. Where all the fowls are kept in a single flock, as is the custom on the farm, only one variety should be kept, and the purity of this variety must be constantly guarded. Nothing but disappointment can possibly follow the promiscuous intermingling of different breeds or varieties, and more money is returned where a single variety is kept than where several varieties are used. This larger profit is due to the fact that eggs uniform in shape, size, and color will sell at higher prices than those that vary in these characteristics. As the eggs of different breeds differ from one another, it is obvious that uniformity in eggs can be obtained only by keeping one variety of hens. Not only are the eggs of a variety uniform, but the fowls themselves produce a uniform grade of market poultry. Millions of dollars could be added to the value of the world's poultry products if but one variety of hens were kept in each flock.

5. **Mixing of Breeds.**—In some cases it is possible to obtain from a cross of two breeds, pullets that produce a prolific yield of eggs. The progeny of these pullets, however, generally fail as egg producers. Because of this fact, no lasting improvement is made by the crossing of two breeds, and in a comparatively short time a mongrel lot of birds are produced. Nevertheless, many of the existing breeds are the result of crosses; but, as the formation of a new breed is a long and difficult process, such work should be left to the scientific breeder of long training and experience.

IMPROVEMENT OF MONGREL FLOCKS

6. No matter how much or how little poultry is kept, constant effort to improve the flock should be made. If the egg yield is good, effort to better it should be put forth; and if good market birds are being grown, attempts to improve their quality should constantly be made. Mongrel flocks may be greatly improved and, in time, made practically pure by the judicious use of a few well-bred males. To improve the mongrels, one vigorous male of the kind desired is used for each twenty hens of the flock. The offspring of the first year will, of course, be half breeds, and if they are mated with pure-bred fowls of the same variety the following year, the progeny will be three-quarter breeds. If this process is carried on for 5 or more years, a practically pure strain of the desired breed will be produced, provided, of course, that all the old hens and cockerels are disposed of each year and the pullets only are kept. In building up a mongrel flock in this way, care should be taken to use only pure-bred, vigorous males of the variety that possesses the desired qualities. After the third cross, some of the very best yearling hens may be kept over with the best pullets for the following year, but under no circumstances should cockerels bred from these birds be used for mating purposes.

PRODUCTION OF EGGS

CHARACTERISTICS OF GOOD LAYERS

7. Laying Condition.—Hens are in the best condition for laying when they are well grown, completely feathered, in full health and vigor, and supplied with a little surplus fat. The importance of this fat is seen when it is known that the yolk, the part of the egg first formed, consists largely of fat that must be absorbed from the body of the hen. The food consumed by the hen must first of all contribute to the maintenance of the hen's body; growth and egg production will not take place until the other wants of the system have been fully supplied. Although some surplus fat is desirable, a large excess of this material is a great hindrance to egg production. The yield of laying hens is governed largely by the body condition, the ration fed, the way in which it is fed, and by the health and vitality of the birds themselves.

8. Egg-Laying Strain.—There are families of fowl that possess inherent productiveness not found in others of the same breed. This natural trait may be so cultivated that the usefulness of these fowls is increased beyond that of others of their breed. From the intelligent use of this trait, strains of fowls will be established that possess the ability to increase the laying habit in others of their kind. Strains of market poultry or exhibition fowls, as well as those of laying hens, may of course be produced.

An **egg-laying strain,** or family, of fowls is essential for the profitable production of eggs, and the possession of such a strain is one of the chief desires of the poultryman. Although there are many factors of minor importance that continually bar the path of progress, an egg-laying strain of fowls may be developed and established, provided that certain fundamental principles are not overlooked. The task of establishing a laying strain would be less difficult of accomplishment if the ancestry and laying ability of each individual of the flock were known. Very little, however, is known of the performance of individual hens, and until knowledge of each individual of his flock is acquired, the efforts of the breeder are made more or less blindly. Not only must the actual performance of the hen be known, but her vigor and vitality and power of transmitting these qualities to her offspring must be studied.

9. Vigor.—The vigor and bloom of youth may fade, but inherited strength and vitality can be depended on, and the fowls that possess these qualities transmit them to their offspring. Pullets can be bred that lay well during the first 6 laying months of their lives, but unless these pullets possess inherited vigor they soon fail, and at the first molt frequently cease to lay. Hens should be produced that will lay for 2 or 3 years without loss of vitality.

10. Continuance.—Uninterrupted egg production for extended periods is of vital importance. The ability to produce eggs for 2 or 3 years, like the qualities of vigor and large egg yield, should be bred into the flock. To do this thing necessitates the use for breeding purposes of heavy layers that have laid well not only for a single year but for 2 or 3 years. Such individuals have vigor enough to ward off all kinds of ailments and to withstand the severe strain placed on the egg-producing organs by the long-continued egg yield. By the use of heavy-laying hens that possess enough strength to go through the third molt, there is reasonable assurance of success in establishing a strain remarkable for its continuance in the production of eggs, provided, of course, that excellent males are always mated with the females.

An anxiety to have early pullets frequently leads to the use of eggs from immature pullets for hatching purposes. In this way undesirable traits, which are inherited with the desirable traits, may be perpetuated. So little is ordinarily known of the ancestors of the pullets that the only safe way to get eggs for hatching is to use those from hens that have passed through two laying seasons. Eggs from such hens will produce chicks a large proportion of which are endowed with the strength, vitality, and stamina necessary for the long-continued production of eggs.

11. Egg-Laying Type of Hen.—There are many rules that can be more or less successfully applied in the selection of an **egg-laying type of hen.** By carefully studying the body conformation of the best layers in the flock a fair idea of the egg-laying type may be obtained; fowls that have laid well for a short period only are not considered. In order to be classed among the best layers, a fowl must have produced a heavy yield of eggs for more than 1 year. The egg-laying type of hen is endowed with activity, endurance, and constitutional vigor, and possesses a well-developed body in which there is ample room for the conversion of food into eggs. Although most hens of the laying type are good layers, too much reliance must not be placed on type alone, for there are marked exceptions to the rule. The keeping of careful records, both of the breeding and egg-laying performance, is of great help in getting a definite idea of the type of hens best adapted for the continuous production of eggs. As individual performance must be used as a basis for the establishment of the egg-laying type of hen, the identity of each one must be established by the use of identification marks that cannot be lost. Too much importance cannot be attached to the possession of a full knowledge of the egg-producing ability of each hen, for no kind of live-stock can be improved with any certainty without such knowledge. The producing hens are quite as important a factor in breeding fowls as are the producing cows for improving the dairy stock.

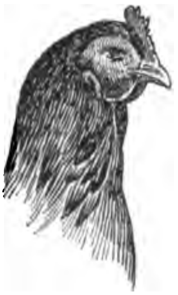


FIG. 1

12. Hens that have the face, comb, and wattles fine and smooth in texture and deep red in color, possess health and the inclination to lay. Excessive development of feathers, comb, and wattles—in fact, excessive development of any kind—is detrimental to the production of eggs. A rough, coarse head and general masculine appearance indicate poor laying ability. The coarse head and face shown in Fig. 1 belong to the poor layer. In the selection of hens to perpetuate a heavy-laying strain, a combination of virtues should be looked for rather than one prominent good quality unaccompanied by others. In short, hens of good, all-around development are the ones to choose for breeding purposes. The brown Leghorn shown in Fig. 2 has a body formation that is desirable in many ways; the hen from which the illustration was made laid over 600 eggs in 2 years and 9 months. Hens of this type can be safely depended on to transmit their egg-laying qualities, and on account of their long-continued performance

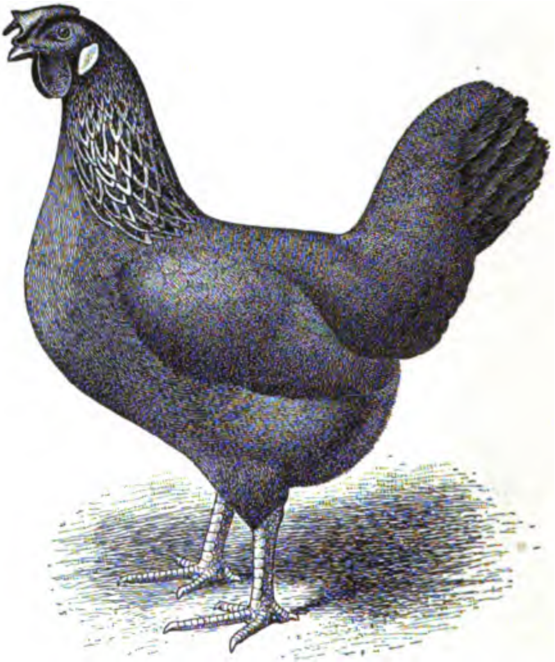


FIG. 2

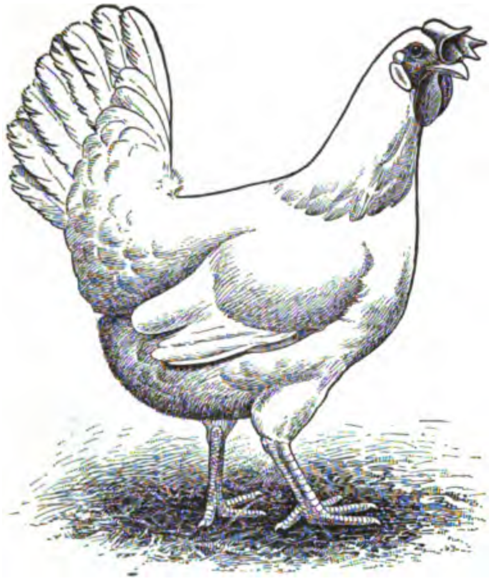


Fig. 3

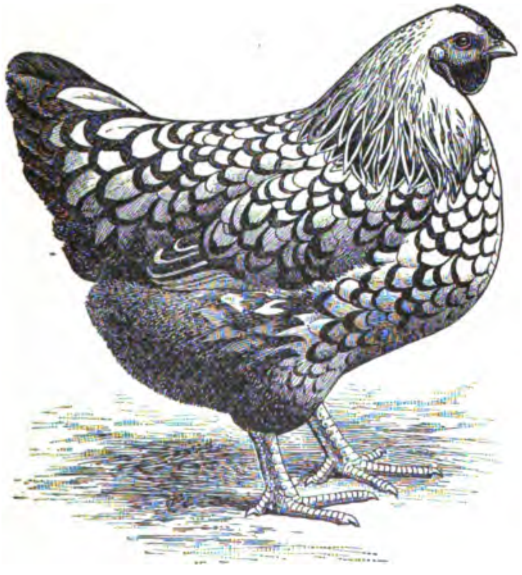


Fig. 4

to give endurance and vitality to their offspring. The white Leghorn shown in Fig. 3 also has a remarkable egg record, as she laid 246 eggs in a single year, and is a type of hen that is well fitted for long service and the economical use of food. Hens of this type are especially desirable for a general utility service.

13. The body conformation of the heavier breeds should follow the same general lines as that of the Leghorns. The body of the Wyandotte shown in Fig. 4 is evenly poised and there is no excessive plumage to retard egg production. This type of hen is a heavy layer and is also an excellent bird for the market. Although the hen shown in Fig. 5 has a breast well developed for the production of table meat, it should not be used either for eggs or meat. The lack of natural development in birds of this type indicates a slight ability for producing eggs. In breeding hens, the desired results can generally be obtained by the use of fowls that serve the dual purpose of producing eggs and meat for the table. The

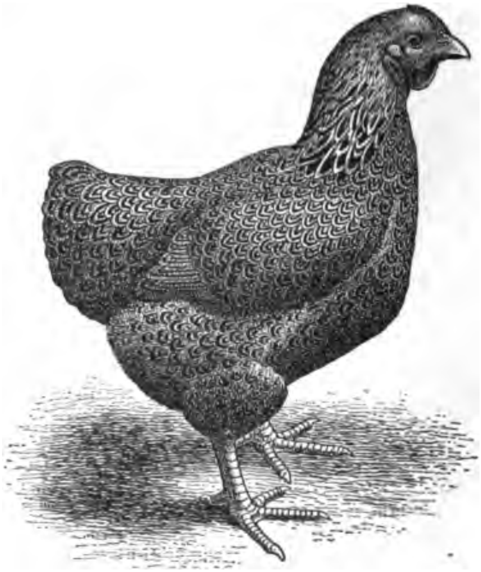


Fig. 5

heavy breeds that have an excess of feathers are less liable to be good layers than are other breeds; some of the heavier fowls are, however, excellent egg producers. The Orpington shown in Fig. 6 has a record of over 200 eggs in a single year, this performance being followed by another year of heavy laying. The rough, coarse head of the Orpington shown in Fig. 1 indicates the drone that returns in eggs little of the cost of her feed and care. As soon as the presence of such a fowl in the flock is discovered, she should be removed. As has been stated, the most necessary requirements for profitable egg production is a strain of fowls that will lay well for 2 or more years. The type of hens best suited for this task should be selected for the production of the flock. To succeed in establishing a heavy-laying strain, no eggs that come from hens that are less than 18 months old should be used for hatching purposes.

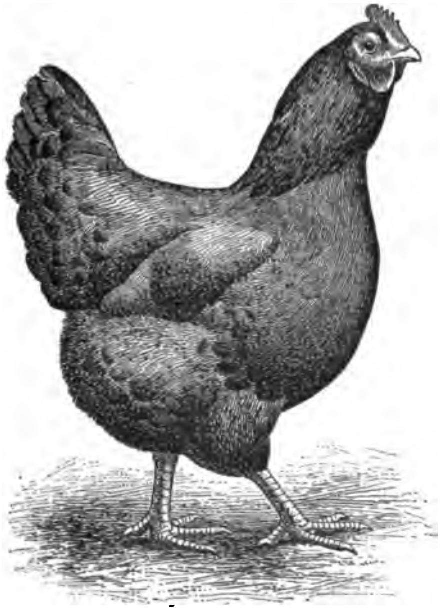


FIG. 6

14. The eggs used must come from hens that have a record of at least 1 year of heavy egg production; and, whenever possible, the eggs for hatching should be selected from hens that have laid well into the third year. Not only must the eggs come from heavy layers, but the hens that establish the strains must have other desirable qualities. The egg records given in Table I show the actual performance of four hens from the same flock and illustrate the importance of selecting for breeding purposes hens with an established record.

TABLE I

3-YEAR EGG RECORD

Year	Number of Eggs Laid			
	Hen A	Hen B	Hen C	Hen D
First	207	186	202	170
Second	185	197	129	30
Third	136	117	96	0
Total eggs laid in 3 years	528	500	427	200

15. A was the strongest and most persistent layer; in her third year she laid more eggs than most hens do in their first year. B and C were also good layers. All three of these hens belong to the type illustrated in Figs. 2 and 3. Although D was a good layer in her first year, she was unable to continue laying the second year. Hens with a record like hers must not be selected to keep up a flock. Her small ability would not have been discovered had she not been retained and a careful record of her performance kept. It is only by keeping such records that the poor layers can be discovered and eliminated, and a desirable strain established. Little is known of the largest possible egg yields, but there are hens that are capable of producing more than 500 eggs in 3 years. With a flock of such hens as an ultimate goal, satisfactory results are bound to be achieved, provided the right individuals are selected to maintain the flock. Pullets that are hatched in the early spring lay at an earlier age than do late hatched pullets. March-hatched pullets frequently lay in July, while those hatched in July seldom lay before the following March.

CARE OF LAYING HENS

16. Use of Males.—Other than to fertilize eggs for hatching purposes, the male is not needed in a flock of hens; in fact, the male is ordinarily a detriment, for the hens will lay equally as well without him as with him, and fertilized eggs deteriorate much more rapidly than do unfertilized eggs. Eggs become fertile about 9 days after the male has mated with the female and remain fertile for the same length of time after the sexes have been separated; these results may occur in a shorter or a longer period, but 9 days is a fair average.

The most perfect male, when mated to inferior pullets, is not likely to produce his equal in quality. Only sons of the best layers should be used as breeders for the production of laying pullets, and these males should be mated to the best females obtainable. The very best seed will not produce perfect plants on poor soil, nor will the best poultry produce well unless it is properly cared for. While food is the source of eggs, its consumption does not force laying unless the hen is well qualified for the transformation of food into eggs. Like some cows that rob the milk pail to fatten their bodies, some hens do not lay, but utilize the food they eat to lay on fat. By means of proper care and feeding, it is possible to secure in 2 years the full yield of eggs from some precocious individuals. On the other hand, such accomplishments are impossible with breeds in which the egg-laying impulse is lacking. In short, to secure the best results, hens must be bred to lay, and the egg-laying instinct cultivated and stimulated in all possible ways. Poultry are among the most plastic forms of animal life, and the fowls themselves may be much improved through selection and their habits and instincts intensified in many different ways.

17. Houses.—Although fresh-air houses may be cold during the winter months, on account of their dryness they are well adapted for the laying hens. Any of the open-front houses that are described in preceding Sections may be used. The size of the houses in the colony system, if that system is practiced, depends, of course, on the number of fowls to be provided for. A large number of hens may be housed and cared for more economically in large pens than in small ones. The one-room open-front house is especially adapted for farm flocks of poultry. The house shown in Fig. 7 is 40 feet long, 16 feet wide, 9 feet high in front, 6 feet high in the rear, and furnishes ample accommodations for 130 fowls, although 160 fowls of the smaller breeds can be safely kept in this house. The house has four glass windows alternating with three openings, each 4 feet high and 5 feet long. These openings are provided with two muslin-covered frames that hang from the top and which swing inwards. The foundation for the

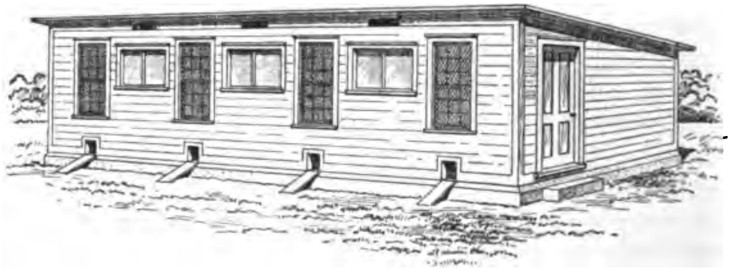


FIG. 7

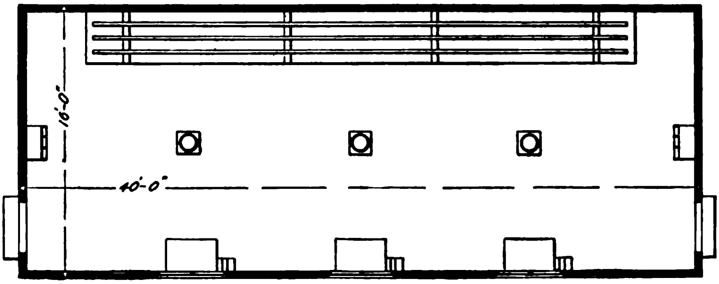


FIG. 8

house and the floor are made of cement. The foundation should be made so as to extend at least 1 foot beyond the house line. After the base beams have been laid, the cement floor may be made inside of them. The floor inside the house should be at least 6 inches higher than the surrounding ground.

18. Fig. 8 shows the floor plan of the house and Fig. 9 shows an interior view. The roosts are shown at *r*, feed hoppers at *h*, the water pans at *w*, and the nests at *n*, where they are easily cleaned. The interior equipment should be so made that it can easily be kept in a sanitary condition. The nests are located preferably near the windows. The interior of the house is equipped with reference to speedy cleaning and proper sanitation; all equipment can be taken out of the house. The ceiling and walls can be brushed and sprayed to insure against the accumulation of insect vermin.

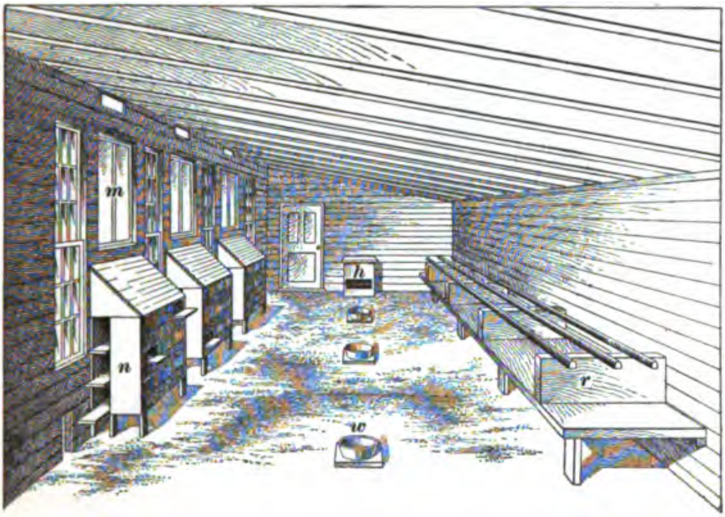


FIG. 9

19. Fig. 10 shows in detail the construction of the nests. They are made of light lumber and are fastened to the wall with iron hooks, thus being readily removed for cleaning. Each nest must not be less than 12 inches square; the alighting board *a* is 8 inches wide for American breeds and 6 inches wide for smaller breeds. For Leghorns, three tiers of nests may be made, and two tiers for other breeds. There should be an open space at least 10 inches in height below the nests. In using the nests, the hens alight first on the board *a* and then pass through the opening into the nests, the eggs being gathered through the doors *b*. By using this kind of nest, the eggs are kept out of the hen's sight, thereby practically preventing the formation of the egg-eating habit.

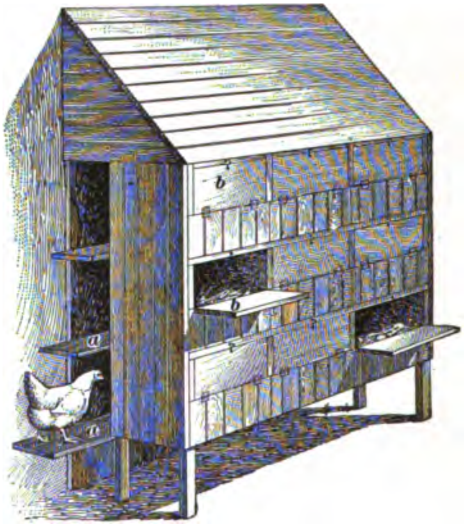


FIG. 10

20. Food and Surroundings.—There is no one ration that is best for laying hens, and no method of feeding can be given that will produce a good yield of eggs under all conditions. Thought, care, and personal attention must be given to the feeding of laying hens, and the environments of different flocks must be considered in thinking of their needs. Those that live in the direct rays of the sun without other shade or shelter than that furnished by the inside of an excessively warm house cannot lay many eggs, nor will hens be profitable that are compelled to wander about through slush and snow in search of food that they cannot find. Contentment is a factor that must not be overlooked. Hens that are contented with their surroundings are more productive than those that are discontented. To lay well, hens must be satisfied and happy, and they must feel at home in the quarters provided for them. The happy hen sings and lays, while the discontented ones become thin in flesh and non-productive. Hens love quiet and congenial surroundings, and they resent noise and disturbance of any kind. Many attendants, strange persons, dogs, animals, or birds coming suddenly on hens strain their nerves and interfere seriously with the egg yield.

21. Disposal of Surplus Individuals.—The young cockerels that are not to be used for breeding purposes are generally sold before they mature, as they frequently bring as much at this period as when fully grown. No advantage is generally secured by feeding them beyond the broiler size unless they are caponized or are otherwise prepared for larger growth. All male birds that are more than 1 year old, hens that have passed the second year, and all drones, or non-layers, are sold for meat, either just before the molt or early in the winter. None of these mature individuals should, however, be disposed of until it has been properly fattened, as the fowls that are thin in flesh do not bring the price per pound that well-fattened birds do. From the foregoing it is seen that careful records of the flock must be kept, and that care and judgment must be exercised in separating the profitable hens from those that are unprofitable.

SMALL FLOCKS IN COUNTRY AND TOWN

22. Farm Flock.—From 100 to 300 hens ought to be kept on each farm, the **size of the farm flock** depending mainly on the taste and desire of the owner. No larger flock than one that can be housed comfortably and willingly cared for should be kept. If more than 300 hens are kept, a poultry department is formed that requires practically the entire time of one person. The poultry houses should not be located too near the family dwelling, as the convenience of caring for the fowls that are so located is more than offset by the nuisances committed about the house by the fowls. They should not be fed near the house, for if they are fed elsewhere they will be less liable to become objectionable about the dwelling. Fowls kept on the farm should be culled and separated with a care equal to that given to the culling of the most carefully bred flocks. The hens should be selected for their ability to produce eggs and market poultry combined. General-purpose fowls are the best for these purposes, and they can be culled, selected, and bred to an efficiency that will increase the profit from them to more than double the amount that can be made from promiscuous lots.

23. As stated, a single variety is best for the farm. The kind to keep is the variety best suited to the fancy of the owner and to the locality where kept. In making a selection, the kind of eggs and the kind of market poultry that sell best should be considered, and the variety that will produce both eggs and table meat to the best advantage should be chosen for farm flocks. Egg production should have first consideration. Eggs are more cheaply produced on the farm than elsewhere, and when produced they are a daily source of income. Farm flocks of well-selected hens should lay 10 dozen eggs per hen each per year, and hens can be bred and fed to lay 12 dozen each per year. Hens that lay well may also produce the best of table meat. Both qualities are to be found in many varieties of several breeds, and when a selection has been made both traits should be intensified through selection and careful breeding. The only difference between the selection of the farm flock and that of the breeder of fowls for exhibition is that the former should be selected for utility and the latter for utility and beauty combined. No more time is required to select a flock and care for it properly than to do similar work in a slovenly way. A well-selected flock of one variety can be kept with no more expense than a flock of mongrels, and the former flock pays for its keep and returns a liberal profit, while the latter flock is often kept at a loss.

24. Small Flocks in Town and City.—Because of the artificial conditions under which they live, the small flocks of hens on town and city lots must receive better care and attention than similar flocks in the country. Fowls living in cramped quarters, like people in crowded cities, suffer from the effects of a confined existence, and in both cases special arrangements for sanitation must be made. Unless special precautions are taken, the crowded fowls will suffer from an insufficient supply of green food and of bugs and worms, and also from a lack of exercise in the open. To induce the hens to exercise, their food may be placed beneath a deep layer of litter; in some cases as much as 18 inches of litter is used. When the litter is as deep as this, a 4-day ration of small grain may be buried beneath it, as the labor of getting the food under these conditions is so great that the fowls will seldom take more than they need. The greater needs of good layers are supplied through their more active efforts to get the food. By the use of this system of feeding, each hen receives what food she needs, and the labor of caring for the flock is greatly reduced. In spreading the straw, the entire floor should be deeply covered, for if but a small amount of litter is used the hens will scatter it and gorge themselves with the grain beneath. The same straw may be used as long as it remains dry and clean, care being taken at each feeding time to shake and turn the straw and to spread it evenly over the floor. The ration in this system of feeding should be a laying ration, and should be composed of small grains and cracked corn. No whole corn can be used, nor should the system be supplemented with any form of hopper feeding.

No other kind of food for laying hens equals scraps from the table; when fed they should be cut into small pieces and mixed with wheat bran. Small flocks may be fed almost wholly in this way. As a supplement to the scraps and to induce exercise, small amounts of small grain and cracked corn may be fed in the litter or buried in the ground.

UNDESIRABLE CONDITIONS

25. Fluctuation of the Egg Yield.—The yield of eggs begins to decline in the warm months, just before the molt begins—in the Northern Hemisphere, in July and August. In that hemisphere the yield steadily declines until November or December, when the minimum number of eggs is produced. In January, the yield begins to grow larger and increases steadily until the growing season, the maximum usually coming in April or May. The rise and decline of the egg yield are, of course, reversed in the Southern Hemisphere. Fig. 11 shows the percentage yield of eggs by months in the United States as compared with Australia. As shown by this figure a daily egg yield of 73 per cent. during December may be obtained from a flock of good hens in Australia while in that month in the United States similar hens may give but an 18 per cent. yield.

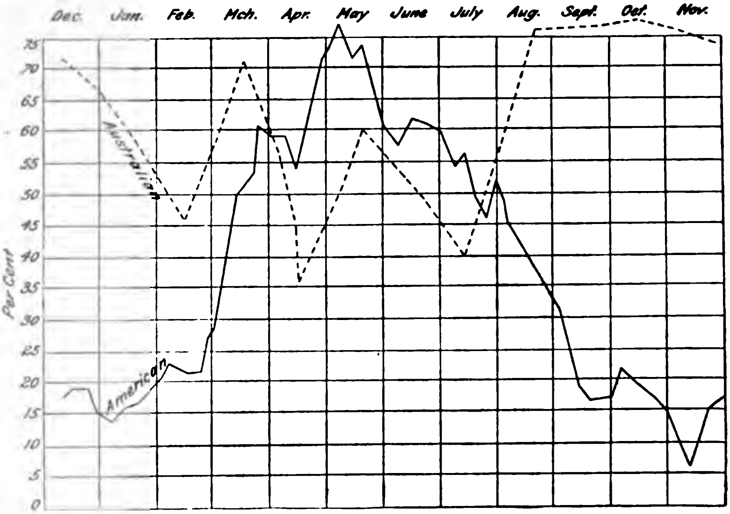


FIG. 11

In all localities the fewest eggs are produced during the season of molt and the period immediately following that season. In the United States, the molt occurs during the months that intervene between July and January. Naturally, eggs will sell for the highest prices at this time. Hens should be encouraged to lay during these months. To accomplish this, pullets must be hatched in March or earlier, and hens should molt during August. There is more heat and less cold in Australia than in the United States, but the greater profit will be made when a prolific yield of eggs during the winter months has been secured.

26. Egg-Eating Habit.—Probably the worst habit that hens acquire is that of **egg-eating.** This habit is often induced by the eating of eggs that are sometimes broken when laid on the floor or dropped when the hens are on roosts. Eggs that are left in the nests until they are frozen and broken also expose the hens to temptation. Fowls of all kinds that are out of condition, poor, or abnormally hungry, will peck at the eggs until the shells are broken, and will then eat the egg to satisfy the craving for food. Lack of lime in the ration will also induce the birds to peck at the eggs. Probably the main cause of egg-eating is idleness on the part of the hens. Fowls that have their liberty or fowls that have to search and exercise to obtain their food, seldom acquire the egg-eating habit or other bad habits.

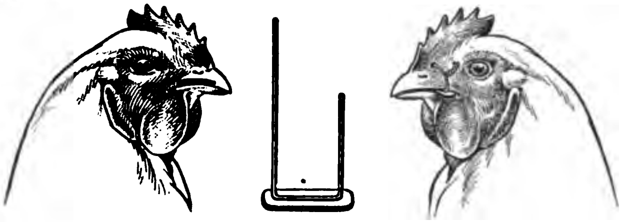
27. Prevention and Cure of Egg-Eating.—The formation of the habit of egg-eating can be prevented more readily than it can be cured. The formation of the habit may be prevented by properly caring for the fowls and by feeding them an abundant ration of suitable food. Through the use of dark or hidden nests, temptations will in a large degree be removed from the fowl. The use of nest eggs is not recommended, for, by the use of china eggs or of eggs made of other hard material, the hens' eggs are frequently cracked and broken, causing not only the loss of the eggs but also the formation of the egg-eating habit. If nest eggs are used, however, they should be made of soft, light wood. Plenty of hay, straw, or other soft material must be used in the making of the nests if the danger of breaking eggs is to be reduced to a minimum. If the habit of egg-eating is prevalent in a flock of hens, the individuals that have acquired it should be separated from the rest of the flock, for these hens will not only eat the eggs they lay themselves but they will also eat those laid by other hens, and will teach other hens to do likewise.

28. The egg-eating birds should be confined in pens unlike those that they came from. The habit may be broken in several ways. Rotten eggs may be placed in the nests and the explosion that comes from the breaking of these eggs and the bad odor and taste of the contents may so affect the hens that they will not trouble other eggs. Large quantities of eggshells as nearly whole as possible may be placed near the nests and the hens may eat so many of these that their appetite for whole eggs will be destroyed. Eggshells filled with various mixtures are also used to break the habit. The efficiency of these usually varies and a cure is not always effected. One of the best mixtures is as follows: Equal parts of whiting, mustard, and cayenne pepper mixed and moistened to a pasty consistency with linseed oil, in which has been mixed a few drops of eucalyptus oil. Bread soaked in paraffin oil is another substance with which to fill the eggshell. Linseed oil to which has been added eucalyptus oil at the rate of 10 drops to a half pint of the linseed oil is also a satisfactory liquid for mixing with bread or other material that is used to fill the shells. A male bird may at times be the offender; when this is the case he should be removed, or otherwise he will teach the habit to all the hens through his efforts to coax them to the nest. In flocks in which the habit is strongly established there will doubtless be some individuals in which the habit cannot be corrected. In such cases the birds must, of course, be killed.

29. Feather Pulling.—One of the most annoying bad habits of hens is **feather pulling.** This habit may be acquired by fowls of all kinds; cage birds and even wild fowls sometimes pluck one another or themselves. Cockerels kept in small enclosures will pluck one another; hens also will pluck one another under like conditions. This habit is generally induced by a search for something lacking in the food or in the body of the fowl. Frequently the habit begins with the plucking of the neck or hackle feathers from the males. Many times this habit results from idleness. Lack of occupation leads to the formation of habits that can be avoided through forced activity in a search for food. The habit of feather pulling or plucking should be distinguished from the more disgusting habit of feather eating. The former habit, as before stated, may be an acquired habit from a lack of something to occupy the attention of the fowl, while the latter habit may be indulged in by fowls that have their freedom.

30. Feather Eating.—The habit of **feather eating** may develop from the more simple one of feather pulling or it may be caused by the search for a minute mite, a parasite that hides close to the roots of the feathers. To rid themselves of this pest, the fowls pick and pluck at their own plumage and at that of others until, in many cases, the blood is caused to flow. When this thing occurs, the feathers and blood are eaten greedily by the fowls, and in some instances their taste becomes so depraved that they eat the flesh from one another, thus literally eating one another alive. If the birds are exposed to the sun, the sore spots on their bodies become blistered and cause much pain. Even this pain does not prevent the fowls from reopening the sores. When the habit has become fairly established, it is most difficult to eradicate, and entire flocks of fowls sometimes become non-productive through its prevalence. Its formation, however, may be prevented through cleanliness and care. Feather eating may also be caused by a poor condition of the fowls or by the lack of food that is found on the open range but which is not present in the daily ration of confined fowls. By calling the hens to feed from his beak, the male bird may teach the hens to peck at his face and feathers.

31. **Relief From Feather Pulling and Feather Eating.**—As has been stated, bad habits can be avoided more easily than they can be cured. Feather pulling and feather eating seldom occur in flocks that are well fed and cared for; but if the fowls are neglected and kept closely confined, bad habits among them can hardly be avoided. Feather pulling that is a result of the annoyance of mites may usually be stopped by applying to the roots of the feathers and to the skin of the fowl oil of sassafras, oil of cloves, or a mixture made of ¼ ounce of carbolic acid or creosote and 1 pound of sweet oil or lard. Carbolated vaseline will destroy the mites and afford relief when applied to the sore places. The pain caused by feather and flesh eating may be relieved by the application of crude petroleum.



(c) (a) (b)

FIG. 12

32. A complete change of diet should be given to the hens as soon as the first indication of feather pulling is observed. Plenty of exercise in the open, an abundance of green food, and but little or no fattening food are beneficial, and by feeding a tablespoonful of equal parts of Epsom salts and sulphur to each twenty fowls, the blood is cooled and the irritation removed. The salts and sulphur can be fed in the mash food; the use of fattening food is to be avoided. Bread and milk make a good substitute for mash, as does linseed meal for meat. When all the damage in a flock is due to a few individuals, they should be removed from the flock and be killed or kept in a pen by themselves.

33. To prevent feather pulling, a poultry bit, shown in Fig. 12 (a), made of wire is fastened between the upper and

lower mandibles of the beak by passing the wire through the comb or nostrils, as shown in Fig. 12 (*b*). Another simple and effective preventive is that of shaving, or cutting, the sharp edges of the upper portion of the beak, as shown in Fig. 12 (*c*), so that a feather placed in the beak cannot be held by the fowl. If the fowl cannot hold the feather in the beak, feather pulling cannot be accomplished. Neither of these remedies will prevent the fowl from eating.

34. Excessive Fatness.—Fat hens lay but few eggs and those hens that are excessively fat cannot lay because both ovaries are encased in fat. For this reason, an excess of fat in the ration is to be guarded against, especially in the summer time.

EGGS

SELECTION OF EGGS FOR MARKET

35. Throughout the year the greater part of the eggs on the market are the surplus farm eggs—that is, the eggs in excess of those needed for home consumption. The greater part of eggs for storage are gathered during the fall and winter and early spring. Because of the readiness with which eggs decompose when exposed to heat, the summer eggs are nearly all consumed in places near which they were produced. Eggs that are gathered throughout the country are sent usually to the largest near-by cities where they are graded by candlers, repacked by them, and sent to various distributing points in the thickly settled parts of the country.

In candling, each egg is held against a white light in a manner similar to that in which incubating eggs are tested for fertility. If only a very slight tint is apparent, the eggs are graded as strictly fresh. If the tint is pronounced, the eggs are known as fresh; where spots are apparent, the eggs are classed as spots; and if the spot shows evidence of decay, the egg is classed as a rot. A lot of mixed eggs generally sells as if they were all of the lowest grade in the lot. Millions of dollars could be saved by the farmers of the United States if they practiced greater care in grading their eggs and in sending them to the market frequently.

36. Color of Eggshell.—The location of the original home of a breed of fowls can usually be inferred from the color of the shell of eggs laid by them. Fowls of European origin lay white-shelled eggs, while those of Asiatic origin lay dark-shelled eggs as a rule. The eggs of different varieties of the same breed may differ slightly in color; for example, the eggs of dark-plumaged birds are darker in color of shell than those from the lighter-plumaged birds. A cross between two breeds one of which lays brown-shelled eggs and the other white, results in eggs that have a color intermediate between the brown and white. There is also considerable variation in the color of eggs from different individuals of the same variety. The color of shell produced by the breeds most popular as egg producers is shown as follows:

BROWN SHELLS

- Brahmas
- Cochins
- Dorkings
- Dominiques
- Faverolles
- Indian Games
- Javas
- Langshans
- Orpingtons
- Plymouth Rocks
- Rhode Island Reds
- Wyandottes

WHITE SHELLS

- Anconas
- Andalusians
- Crèvecœurs
- Campines
- Games (some have a tint)
- Hamburgs
- Houdans
- Leghorns
- La Flèche
- Minorcas
- Polish
- Redcaps
- Spanish

37. The color of the shell is more pronounced in the eggs first laid than in those laid later in the season. Hens that continue to lay frequently for several months suffer a loss of color of beak, shanks, and skin. The strain of long-continued egg production is responsible for this loss of color. The yellow coloring matter in the parts mentioned is probably required to give color to the yolk. The loss of color is more pronounced in fowls that do not have free range. A plentiful supply of grass or other green food largely prevents loss of color in legs and beak and adds to the rich appearance of the yolk. The color of the eggshell is apparently not influenced by the character of the food consumed.

38. The color of the shell has some influence on the price of eggs in the markets of New York and Boston, New York preferring eggs having white shells, and Boston those having the darker shells. The matter of color of shell is one of small importance in the other markets. The color of shell is not dependent on the chemical analysis of the egg, nor is edibility governed in the least by the color of the shell of the egg. Eggs are flavored entirely from the food and water consumed by the hens. Eggs may contain an excess of water, or have a thin albumen, as the result of a poor physical condition caused by a lack of protein in the food. The same condition is present in eggs that have been kept in a cool place and quickly removed into warm or hot temperature prior to being used. Products that have the appearance of complete eggs but which are composed entirely of albumen may be formed in the oviduct, covered with shell, and passed out of the hen. Such products result from a lack of yolk formation or through internal disease of some kind. Eggs completely formed and having yolks only and no albumen are the result of an excess of yolk-forming material and a lack of albumen in the system.

39. Fresh-Laid Eggs.—No market product has a more ready sale than fresh-laid eggs or eggs of good quality that are less than 1 week old. There is no product, vegetable or animal, whose value depends more directly on freshness and freedom from chemical change than eggs. As soon as the egg is laid, the moisture within it begins to evaporate, and chemical changes that injure its food value begin. Both these processes go on much more rapidly in heat than in cold, and it is for this reason that eggs deteriorate quickly when they are exposed to heat, and frequently their value as a food is entirely destroyed by a few days of exposure to hot weather. This damage is much greater to fertilized eggs than to unfertilized eggs. Fresh-laid eggs of known good quality that are shipped into the market within 3 days of the time they were laid are sold as fancy hennery eggs, and generally sell for higher prices than do other grades of eggs. Often fresh-gathered eggs are graded in the market by candlers as fancy, strictly fresh, and fresh eggs; none of these grades, however, are equal in value to the fancy hennery eggs.

40. Size of Eggs.—The size of eggs intended for market is equal in importance to other requirements. Marketable eggs should be of uniform size, shapely in form, even in color, and should weigh not less than 2 ounces each. Eggs that weigh 45 pounds to the crate of 30 dozen bring a much better price in the market than do eggs of smaller size. In the production of eggs, size may well be considered prior to the large yield. The size of eggs can always be improved by selecting for hatching only eggs that weigh 2 ounces or more apiece. Eggs that are excessively large are not usually more desirable as a market product than are the market sizes; eggs that average 2 ounces will fill the cases evenly to the top, and the appearance of such eggs is attractive. Nothing in the egg line is more attractive than are eggs of large size that have clear, clean, glossy shells, and that weigh 2¼ ounces or more apiece, but such eggs are not profitable when sold in the general markets, and for this reason there is not much advantage gained through the production of exceedingly large eggs. Eggs a size larger than are usually produced may be selected for home consumption or near-by trade that is anxious to have the large specimens and is willing to pay a large price for them. The larger the eggs, the fewer of them will the hen produce, and there is no advantage to be gained in a monetary way through sending abnormally large eggs to the market. The additional value that is derived from eggs weighing over 2 ounces does not offset the fewer number that the hens will produce of the larger kind.

41. Care of Eggs.—Large profits are impossible where attention is not given to details. In no operation is better pay received for doing little things than in the care and preparation of eggs for the market. It is by no means uncommon for some of a lot of eggs to sell for as much as 38 cents per dozen, while others of the same lot sell for 14 cents or even less. The difference in price is the penalty paid for slipshod methods and slovenliness. Its shell is the only thing that prevents the staleness of an egg from being discovered, and the expert is not often deceived even by the shell, for on fresh-laid eggs is a bloom or finish caused by the coating of albumen deposited outside the shell. This bloom becomes less brilliant each day, the process being hastened by heat and retarded by cold. As the coating departs, the pores in the shell open and evaporation of its contents is hastened.

The importance of cool storage is seen when it is realized that eggs are fresher after 3 weeks of storage in a cool place than after 7 days of storage in a temperature of 70 degrees. To keep the yolks from settling to one side, the position of the eggs is frequently changed. This is done by inverting the box or case in which the eggs are packed. As soon as eggs are laid they should be taken to a cool place, and as little time as possible should be lost in sending them to their destination. During hot weather the eggs should be stored in a cool, dry place. Cellars that are musty or tainted with odors of oil, roots, paints, or decayed vegetables are unfit storage places for eggs, for they rapidly absorb bad odors of any kind.

When the temperature is 80 degrees or more, the eggs will not stand shipment for any considerable distance, nor will they be of the best quality for more than 3 days after laying.

42. Small, dirty, or unevenly shaped eggs, or eggs that have rough shells are discounted in value when marketed. Promiscuous lots of eggs sell poorly, because they must be handled and graded before they are sold. The aggregate loss to the farmers because of this haphazard way of marketing their eggs is serious, but may be almost entirely obviated by

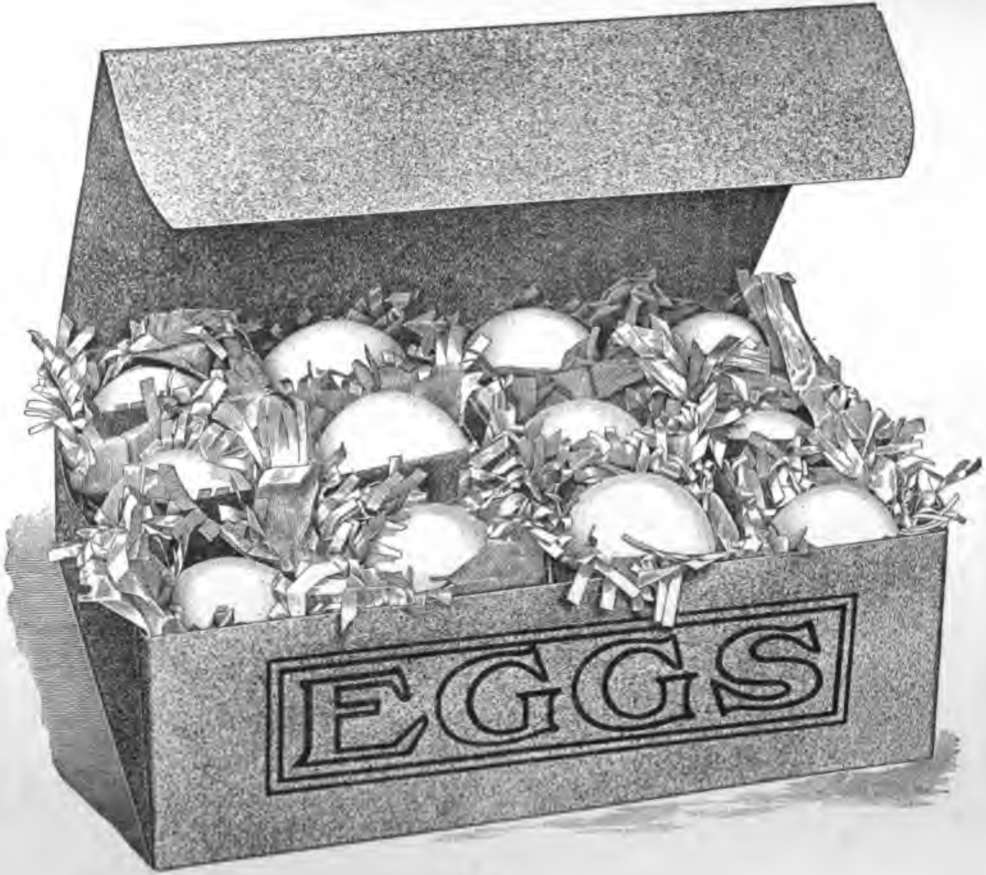


FIG. 12

the observance of a few simple rules and customs in handling the eggs. The nests in which the eggs are laid must be kept clean, thereby preventing to a great degree the eggs from becoming stained with excrement. By frequently gathering the eggs they will be prevented from being heated and spoiled by broody hens. When the eggs are gathered, the nest should be shaken up, cleaned, and reshaped. Broody hens must be removed as soon as they are discovered, for eggs that are exposed to the heat of the hens for a single night are unfit for shipment. Eggs ought not to be washed, for the washing spoils the bloom or finish, and injures the keeping qualities. In the same way, eggs that are rained on in transit are much injured.

43. Washing of Eggs.—When eggs are so badly soiled as to need washing to fit them for market, they should be cleansed in one of several ways. A solution made from 1 ounce of ammonia and 2 quarts of water will remove dirt and stains from the shell of the eggs, and when they have been carefully cleaned in this solution, their appearance will be injured but little. Eggs may be washed in warm water and rubbed dry with a piece of cotton cloth or flannel. If the stains are deep, they may be removed by rubbing with dry, coarse salt. When cleaned in this way, they should be rinsed in lukewarm water. Stained eggs may also be cleaned in lukewarm water that contains a small amount of soap.

When soiled eggs have been cleaned in any one of the foregoing ways, their appearance may be improved by rubbing them briskly with a cloth that has been moistened in a solution of vinegar and salt. This solution is made up of 4 ounces of salt to 1 pint of vinegar. This treatment is not necessary for eggs that have been washed in water containing ammonia. Eggs may be cleansed by washing them in sweet milk, buttermilk, or in a solution of water and vinegar, 3 parts of water to 1 part of vinegar in which a tablespoonful of salt has been added for each pint of the liquid. To clean the eggs in this way, they should be soaked in the milk, buttermilk, or water and vinegar for not less than an hour, removed and rinsed perfectly clean in lukewarm water that has a little glycerine added to it. When rinsed in this solution, they should be removed and placed on a clean, dry cloth to dry. By the use of glycerine, the bloom or finish is partly restored to the shells.

44. Egg Packages.—Eggs for retail should be packed in small paper boxes that hold a dozen eggs each. A box made for the purpose is shown in Fig. 13. Such boxes can be purchased at little cost. Eggs packed in boxes should be carefully selected for evenness of size, shape, and color; evenness of color is most desirable. When the eggs are placed in the boxes, a small piece of tissue paper cut square should be placed about them and the eggs pushed into the division, small end down. Blue tissue paper should be used for white-shelled eggs, and white tissue paper for brown-shelled eggs. For some markets, packages of this kind will add a value of several cents to each dozen of eggs offered for sale.

Eggs are usually sent to market in wooden egg cases in which are used sheets of strawboard and fillers of the same material, the strawboard going between the layers of eggs, and the eggs being placed in the fillers, small end down. When these are used, care should be exercised to use only clean fillers. If the fillers are soiled with dirt and contaminated with odors, this will injure the value of the eggs. Rats and mice may possibly build their nests in fillers that are awaiting use. When this occurs, the fillers are apt to be so soiled and polluted with bad odors that they are unfit for use. No boxes or packages of any kind that are not perfectly sweet and clean should be used for carrying eggs.

STORAGE OF EGGS ON THE FARM

45. Eggs fresh from the nest can be kept in good condition if placed with the small end down in a box or basket and covered with bran. They should not be packed until all the animal heat has passed from them. They will keep best if packed in a cool place and kept there. The bran that fills in close about them will exclude the air sufficiently to remove the possibility of much evaporation. At the same time, there will be sufficient circulation of air through the bran to prevent the eggs from becoming moist or moldy. Eggs can be packed in egg cases with the small ends down, and the divisions filled in about the eggs with bran, shorts, or similar material, to keep them as above described. Eggs that are kept in pans or boxes should be moved each day from one receptacle to another, and should be placed with the small end down as much as possible.

46. Small lots of eggs can be kept at home in cool cellars by first covering the eggs with table salt. The salt should be used fairly dry. First a layer of salt is spread over the bottom of the crock; then a layer of eggs is placed small end down; more salt and more eggs until the crock is entirely filled. Eggs may be kept in the same way packed in bran, but they will keep a longer time when packed in salt than they will when packed in bran. Eggs that have been gathered during cool weather, packed in salt, and kept in cool cellars, will keep for several months; packed the same way in bran, they may keep from 60 to 90 days. Much depends on the careful packing and the temperature of the cellar in which they are kept. This temperature should never exceed 50° F.

47. Eggs laid during the early months of spring are desirable for storing. These eggs are usually produced in an average temperature of 60 degrees. Eggs laid in the fall will keep equally well. Such eggs can be safely stored at home, or they can be kept in storage houses with the assurance that they will pass through the required time and come out almost as good in quality as they were when stored. Summer eggs are less desirable. They are usually produced in a temperature that is almost warm enough to start the growth of the germs within the shell. The slightest exposure of these eggs to a temperature above 90 degrees is apt to spoil them for keeping,, and for these reasons it is never best to attempt to store them for future use.

48. Preserving of Eggs.—Eggs that are laid during the month of April should, if possible, be selected for storing, as they will keep better than will other eggs. Eggs laid in May and June are next best, but they are not quite so good for the purpose as are the eggs laid in April. The reason for this lies in the fact that April eggs are usually very choice, from the fact that the fowls can have a plentiful supply of fresh-grown green food, which food adds a rich color to the yolk and a delicate flavor to the eggs. Some eggs do not keep well, however, no matter when they may be laid. Hens that have the free range of barn yards, cow barns, and pig pens are apt to gather food that will be likely to taint the flavor of the eggs. Such food may transmit conditions to the eggs that are detrimental to their keeping properties. When eggs are perfectly fresh in every way, they will keep remarkably well, provided they are gathered as has been stated, during weather that is not warm, and are put into the preservative as soon as the animal heat has left them.

The success obtained from preserving eggs depends largely on the care given to the selecting of the eggs, the preparation of the liquid, and the placing of the eggs where the temperature will be even and cool. Eggs of bad flavor will not improve in this or any other manner of preserving. Eggs that have a bad odor before being put into the preserving liquid will deteriorate rather than improve. Eggs of poor quality will not be made better, but good eggs will keep and remain good food when they have been put away properly.

49. Eggs may be preserved in **lime water,** provided they are kept in tall vessels; either stone crocks or butter tubs can be used. The liquid for covering the eggs is made in the proportion of 3 gallons of water to 1 pound of salt and 1 quart of finely slaked lime, the lime and salt to be mixed in the water. This is to be stirred frequently for a period of 1 to 2 days. Following this, the liquid should be permitted to settle. The crock or tub is then almost filled with eggs, placed, as far as possible, with the small end down. The clear liquid solution of lime and salt is poured over them until the surface of the water is fully an inch above the top of the eggs. The vessel should be kept in an out-of-the-way place, where the temperature will not exceed 50° F. A thin covering of lime will form on the top of the liquid. If undisturbed, this covering will protect the contents from outer influences.

50. A solution made of 1 gallon of silicate of soda, or **water glass,** and 9 gallons of water is an efficient preservative for eggs. The water glass must be dissolved in warm water and must be well stirred until thoroughly mixed with the water. When cool, this solution should be poured over eggs placed in vessels as described in the foregoing paragraph. Eggs will keep fairly fresh in this solution for 5 or 6 months, and they have been kept in edible condition for a year in a solution of this kind. This can be accomplished, however, only when they are kept in cool places and in a temperature that does not exceed 45° F. Experiments have shown that under some conditions a solution of 5 per cent. of water glass and 95 per cent. of water will answer well for the keeping of eggs; and they will keep fairly well in a 3-per-cent. solution of the same material. The amount used depends on the strength of the water glass, which is a chemical preparation that may be of several strengths. When the water glass used is of the highest grade, less is required than of the lower grades.

51. When the eggs are removed from either of these solutions they should be rinsed entirely free from the lime water or the solution of water glass. To do this, the eggs can be placed either in a sieve or colander, and running streams of fresh water permitted to pass through them, or buckets of fresh water may be poured over them. After being thoroughly rinsed, and before they are packed for shipment they should be laid out either on a dry cloth or on boards until they have become thoroughly dry.

MARKET EGGS

COMMERCIAL QUALITIES OF EGGS

FOOD VALUE AND USES OF EGGS

1. Consumption of Eggs.—Throughout the greater portion of the world eggs are more commonly eaten than any other kind of food except bread. In the United States, the value of poultry and eggs combined is greater than that of all other animal food, and is nearly equal to that of corn. That eggs should be a favorite food may be well understood when it is realized that they combine the qualities of high food value, ease of preparation, and palatability. There is no kind of animal food that can be prepared so readily for the table or for the lunch basket as eggs. But few kinds of foods can be put to so many uses or can be cooked in so many different ways, and but few kinds of food equal eggs in palatability and attractiveness. Eggs are composed of the food principles that best nourish the body; in fact, the chemical composition of the egg and of the human body is nearly the same.

Eggs are also a cheap food; at 25 cents a dozen they are less costly than most meats. A dozen eggs will better serve a family of six than will 1½ pounds of meat, a fair valuation of which is about 30 cents.

Eggs with milk make excellent food for children and invalids; both foods are complete and may be used separately or together. On account of their many advantages, the con-

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sumption of eggs has greatly increased within the past few years, and undoubtedly will continue to increase as improvements are made in packing and shipping.

The weight of eggs depends on the breed of poultry that lays them. The average weight of eight hen eggs or eleven guinea eggs is 1 pound. A duck egg weighs 3 ounces or a little more; a turkey egg weighs 4 ounces, more or less; and a goose egg weighs between 6 and 7 ounces.

2. **Composition of Eggs.**—About 11 per cent. of hen eggs consist of shell, 32 per cent. of yolk, and 57 per cent. of white. The white and yolk are made up of 72 per cent. of water. Table I, which is adapted from a bulletin of the United States Department of Agriculture, gives the composition and fuel value of the eggs of the common domestic poultry, and, for purposes of comparison, the composition and fuel value of some of the more common foods other than eggs.

3. **Relative Food Value of Eggs.**—Protein and fats are the food principles found in eggs and in meat; carbohydrates are present in these foods in such small quantities as to be unworthy of notice. A study of the composition of meat and eggs shows for meat a nutritive ratio of 1 to 2.2, and for eggs a nutritive ratio of 1 to 1.76. Although eggs have a narrower nutritive ratio than meat, they do not contain as much protein or fat. Meat will supply more power or force of endurance than eggs and is therefore a better food for persons exposed to cold weather. Eggs are better suited for those who are not so exposed and for use during warm weather. Compared with wheat flour and potatoes, eggs contain more protein and fat but less carbohydrates, and have a closer nutritive ratio. Eggs combined with wheat bread and potatoes form a nutritious diet.

Raw and soft-boiled eggs are digested in about 2 hours; hard-boiled eggs are digested in 3 hours; the yolk of hard-boiled eggs is digested more readily than the white. Meat and bread are digested in about 3 hours, or a little less. The less eggs are cooked, the more easily they are digested.

A comparison of the relative food value of eggs, meat, and bread is favorable to bread, yet bread does not fully supply the needs of the body. If 10 cents were spent for five eggs that contain .6 pound of total food, it would provide .08 pound of protein and .05 pound of fat having a fuel value of 425 calories. The same amount expended for lean meat at 20 cents per pound would buy .5 pound of food material that contains about .08 pound of protein and .09 pound of fat having a fuel value of 694 calories. The same sum spent for bread would buy a 2-pound loaf, which would contain about .18 pound of protein, .03 pound of fat, and 1.06 pounds of carbohydrates having a fuel value of 2,532 calories. From the foregoing it will be seen that eggs do not furnish the heat-producing materials in such large amounts as do meat and bread.

4. Uses of Eggs.—In addition to their use as food, eggs are used to a limited extent for other purposes. The white of an egg is a remedy for burns, and if taken in time it is an effective antidote for poisoning by corrosive sublimate. Food or bones lodged in the throat can sometimes be dislodged by swallowing a raw egg. The oil extracted from the yolk has healing properties, and the inner lining or membrane of the shell can be used as an adhesive plaster. Eggshells, on account of the purity of the carbonate of lime of which they are largely composed, are used in compounding medicine and for several other purposes.

There is a limited demand for rotten eggs for the finishing of some kinds of leather. They may be used as fertilizer, and in many instances they are used in the manufacture of calico. The supply, however, is much greater than the demand, and such eggs bring but a few cents a dozen. Often the price paid for them is not sufficient to cover the cost of transportation, which in most cases is paid by the shipper.

TABLE I

COMPOSITION OF EGGS AND CERTAIN OTHER FOODS

Food	Refuse Per Cent.	Water Per Cent.	Protein Per Cent.	Fat Per Cent.	Carbohydrates Per Cent.	Ash Per Cent.	Fuel Value per Pound Calories
Hen's egg:							
Whole egg as purchased	11.2	65.5	11.9	9.30		.9	711
Whole egg, edible portion		73.7	13.4	10.50		1.0	802
White		86.2	12.3	.20		.6	338
Yolk		49.5	15.7	33.30		1.1	1,825
Whole egg boiled, edible portion		73.3	13.2	12.00		.8	860
White-shelled eggs as purchased	10.7	65.6	11.8	10.80		.6	771
Brown-shelled eggs as purchased	10.9	64.8	11.9	11.20		.7	791
Duck egg:							
Whole egg as purchased	13.7	60.8	12.1	12.50		.8	851
Whole egg, edible portion		70.5	13.3	14.50		1.0	968
White		87.0	11.1	.03		.8	298
Yolk		45.8	16.8	36.20		1.2	1,977
Goose egg:							
Whole egg as purchased	14.2	59.7	12.9	12.30		.9	864
Whole egg, edible portion		69.5	13.8	14.40		1.0	977

White		86.3	11.6	.02		.8	311
Yolk		44.1	17.3	36.20		1.3	1,990
Turkey egg:							
Whole egg as purchased	13.8	63.5	12.2	9.70		.8	736
Whole egg, edible portion		73.7	13.4	11.20		.9	831
White		86.7	11.5	.03		.8	309
Yolk		48.3	17.4	32.90		1.2	1,854
Guinea fowl:							
Whole egg as purchased	16.9	60.5	11.9	9.90		.8	736
Whole egg, edible portion		72.8	13.5	12.00		.9	868
White		86.6	11.6	.03		.8	312
Yolk		49.7	16.7	31.80		1.2	1,788
Miscellaneous foods:							
Cheese as purchased		34.2	25.9	33.70	2.4	3.8	2,158
Sirloin steak as purchased	12.8	54.0	16.5	16.10		.9	1,121
Sirloin steak, edible portion		61.9	18.9	18.50		1.0	1,286
Milk		87.0	3.3	4.00	5.0	.7	348
Oysters in shell as purchased	81.4	16.1	1.2	.20	.7	.4	53
Oysters, edible portion		86.9	6.2	1.20	3.7	2.0	284
Wheat flour		12.0	11.4	1.00	75.1	.5	1,710
Potatoes as purchased	20.0	62.6	1.8	.10	14.7	.8	319
Potatoes, edible portion		78.3	2.2	.10	18.4	1.0	397

CONDITIONS AFFECTING MARKET VALUE

5. Freshness.—The egg as laid is a finished product, its food material being sealed inside the shell, which is made air-tight by a coating of albumen. As long as this coating retains its bloom and remains unbroken, the egg will sell for more than at any other time. If the egg is kept for future use it must be kept away from the dangers that accompany exposure to heat, moisture, and rapid temperature changes. The degree of **freshness** of an egg may be judged from its appearance, the bloom disappearing from the shell and the interior of the egg becoming more or less shrunken with age. Freshness alone, however, is not a guarantee of quality. New-laid eggs may be unsavory because of the consumption of tainted food by the fowls that laid them, and new-laid eggs are often condemned as stale when the only defect is poor flavor.

6. Cleanliness.—Of all the qualities desirable in market eggs, **cleanliness** is one of the most important. To have this quality in eggs it is necessary that strict attention be given to the sanitary condition of the dwellings, outbuildings, barns, stock pens, barn yards, and poultry houses at the plant in which the eggs are produced. If filth is anywhere abundant on the plant, the hens will find it, and, unfortunately, they do not hesitate to eat and drink in unsanitary places. If the food and water consumed by the hens are taken from barn yards and pig pens, the feet and shanks of the hens become filthy and in time they soil the nests and eggs, thereby injuring the appearance and market value of the product.

Bacteria that cause decomposition multiply rapidly in filthy nests, and if from any cause the shell of the egg becomes moist it is easy for the bacteria to enter the eggs before they are gathered from the nests. It is even possible for injurious bacteria to enter the egg before it is laid, infection in such cases being caused by tainted food or polluted water.

Eggs that are perfectly clean and have the bloom of freshness on their shells are practically certain to be free from bacteria.

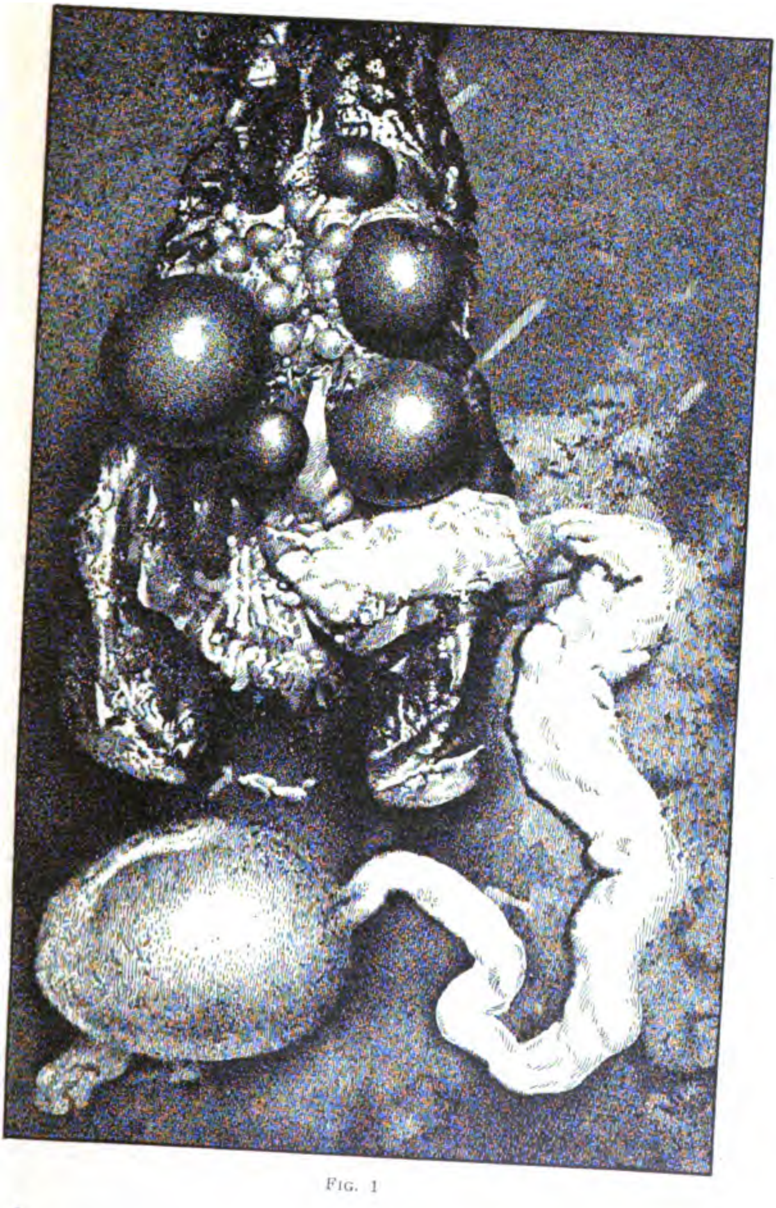

FIG. 1

7

Eggs that are dirty, damp, or affected with stains of any kind have deteriorated and will decompose rapidly if exposed to heat and damp air.

Eggs that are exposed to the attacks of the right kind of flies are fly-blown in the same way as meat in the summer time.

7. **Flavor.**—Cleanliness and **flavor of eggs** are very intimately associated, and cleanliness about the poultry plant and the proper feeding of the hens will assure eggs of fine flavor. Such eggs, when fresh, can be guaranteed to be of first quality and will sell freely at all times at prices far in advance of the market price of ordinary eggs.

Notwithstanding the fact that the eggs of hens vary in shape and in color of shell or yolk, there is little difference in their flavors provided they are cooked in the same manner. The eggs of turkeys and geese have naturally a more pronounced flavor than do the eggs of other fowl, their flavor being even stronger than that of duck eggs.

8. **Decomposition.**—Bacteria, or germs, are the prime cause of **decomposition in eggs,** but they are harmless to the egg unless they can find their way into its interior. They may infect the egg in the ovary or in the oviduct before it is laid; in the nest immediately after it is laid; or in the course of handling after it is taken from the nest.

In Fig. 1 is shown the interior of a hen's abdomen. In this illustration the gradual growth of the yolk and egg from the merest speck to full size is apparent. Whenever there is a diseased condition of the ovary or when bacteria exist inside of the oviduct, eggs in the process of growing will be infected. An infection of this kind may cause the egg to deteriorate more quickly than it otherwise would, or, in extreme cases, even to rot, but such infections rarely cause disease in the consumer, nor do they injure the food value of eggs that are consumed in a short time after they are laid. The ovary or the oviduct of the hen may become infected because of impurities in the food or water supply. If the hen is well nourished on clean food and supplied with fresh water, there is little danger that the egg-producing organs will become diseased.

When the egg is laid the shell is coated with a thin layer of albumen, which fills the pores. Bacteria will not be able to enter the egg as long as this layer remains intact. As soon, however, as the coating is moistened or broken, bacteria of various kinds find a ready entrance, and when the temperature and other conditions are right they cause it to deteriorate in value rapidly.

Unless the nests are kept clean and dry, it is easy for the eggs to become infected with bacteria as soon as they leave the hen. In the process of grading and packing, and, in fact, in all the different steps of handling eggs, care should be taken to see that everything that touches them is clean and dry.

There is less danger of infection in cool than in warm weather. For this reason, eggs laid in the spring remain in a good condition longer than those laid in the warmer season. As eggs that are to be stored must be in good condition, spring eggs are especially desirable for commercial storage purposes. This kind of egg should also be selected for preservation and storage on the farm.

Bacteria in eggs do not multiply in low temperatures, nor do they grow to any extent in a temperature lower than 50° F. At temperatures higher than this their growth is constant and rapid. A sudden change from low to high temperature stimulates the growth of bacteria. This enables bacteria to destroy eggs in the same manner as they destroy milk and all kinds of meat. Eggs in storage should be kept at a temperature of 34° F. or lower. The sudden deterioration of eggs taken from storage is not usually due to bacteria already in them, but rather to the subsequent entrance of bacteria when the albuminous coating of the shell becomes destroyed in sweating.

PREPARATION OF EGGS FOR MARKET

GATHERING AND GRADING OF EGGS

9. **Collecting of Eggs.**—A large part of all the eggs sold come from farms rather than from poultry plants. The collection of eggs begins with the irregular efforts made by the farmer, who takes them to town or to the village merchant, who, in turn, sells them to the traveling huckster. These sales or deliveries are made with no definite regularity, and when the eggs reach the huckster they are of all grades, conditions, and ages. Later they are sent to regular buyers, who sort and repack them prior to sending them to large commission houses in the cities. A large part of all such eggs are from 10 days to 2 weeks old before they reach the commission houses. The condition of these eggs depends, of course, on the season of the year and on the care they have received. If they have been kept cool and have been well cared for they will be in good condition; on the other hand, if they have been exposed to great variations of temperature they will be of inferior quality.

From the beginning of November to the end of December, as much as 25 per cent. of the eggs collected may be worthless, the large loss at this time of the year being due to the infrequency with which the eggs are marketed by the farmer. For similar reasons, 20 per cent. of the eggs are lost that are collected during January and February and from May to October. The smallest loss is sustained when the eggs are most plentiful, which is during March, April, and May. During these months the temperature is fairly cool and the eggs, on account of the great production at this time, are sent to market frequently.

All the loss described must be equalized between producer and buyer, and just as long as the causes are sustained, the prices paid to the producer will be lower and the selling prices to the consumer will be higher than they would be if all the eggs laid could be saved. The loss, of course, is caused largely by the producer, who does not realize the importance of cleanliness in the poultry house, proper care of the eggs, and their prompt delivery to the market. The local buyers, in turn, add to the delay by holding their eggs for larger shipments, in order to save transportation charges.

The conditions in any given locality improve rapidly as soon as better knowledge of the care of eggs and better systems of transportation are obtained. In order to prosper, one must take advantage of all opportunities, and there are countless opportunities for improvement in the selling of eggs as practiced in the United States.

TABLE II

STANDARDS FOR EGGS

American Standard		English Standard	
	Points		Points
Shape	30	Freshness	40
Color and finish	40	Size	15
Weight	15	Texture of shell	15
Condition	15	Uniformity of size, color, and shape	15
		Cleanliness and bloom	15
	100		100

Great saving in the farm districts could be made through a combined effort on the part of both the producer and the buyer to gather the eggs quickly and to store them in a cool place as soon as gathered.

10. Standards for Eggs.—Eggs are graded in many ways. The number of grades varies in different markets; in general,

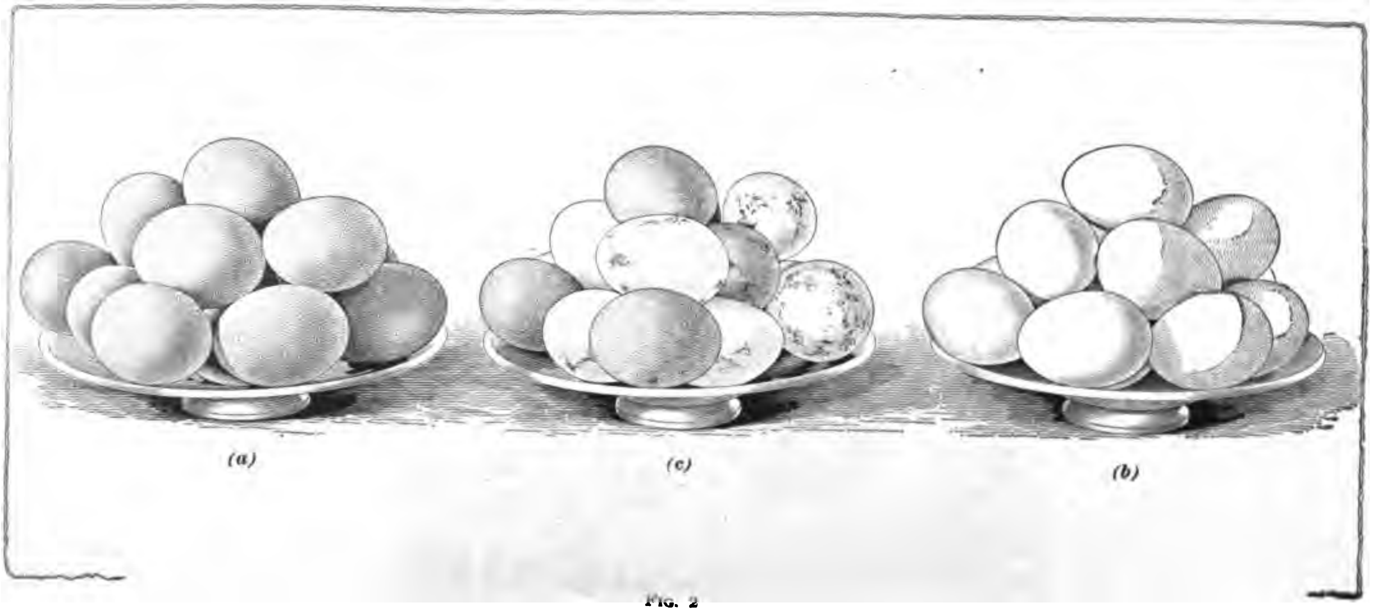

FIG. 2

it may be said that eggs are graded according to their size, shape, color of shell, finish of shell, and general condition.

In England, an official standard of points has been adopted for use in grading eggs, but in America there is no official standard. The American scale of points given in Table II is of local origin and is intended to be used merely as a suggestion rather than as a hard-and-fast standard.

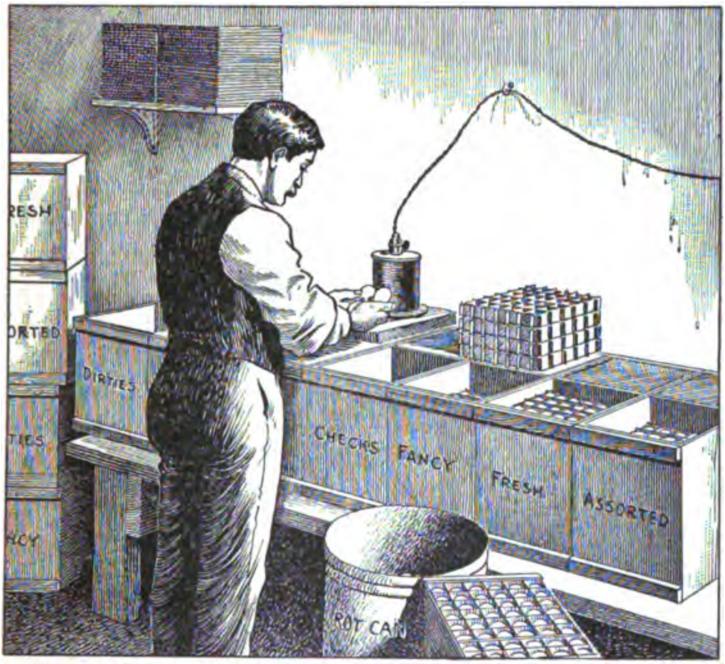

FIG. 3

11. Three Primary Grades of Eggs.—Eggs that are not graded on the farm or poultry plant are gathered by dealers or hucksters and are examined or graded at some central station before being sold or placed in storage. At this point eggs that are undersized, rough in shell, of irregular form, cracked or soiled, are set aside; the other eggs are graded and repacked.

In Fig. 2 are shown what may be called the three primary grades of eggs, which are the brown shelled shown in (*a*), the white shelled shown in (*b*), and those of assorted shades and colors shown in (*c*). These grades are packed separately and shipped to candlers, who still further examine, grade, and pack the eggs for daily sale or for storage. The profit of these dealers comes to them largely through the neglect of the producer. Grading and packing should be done where the eggs are produced, as by so doing the cost of transportation of worthless eggs may be saved, a higher price obtained for the eggs sold, and the candler's profit saved.

12. Candling of Eggs.—In candling eggs, each one is handled separately and is held for an instant before a bright light, thus showing to the experienced candler the condition of the contents of the shell. The room in which the eggs are candled must be dark with the exception of the single light used in the work. The light, which may come either from an electric bulb or an oil lamp, is enclosed in a tin can, box, or other appliance made for the purpose. The candling box shown in Fig. 3 is made of tin and holds the electric bulb in the right position to throw the light directly through the opening in the side of the lamp. When the egg is held in front of the light, its condition is plainly seen and it is placed in the receptacle that contains the class of eggs to which it belongs. The classes are as shown by the labels on the cases.

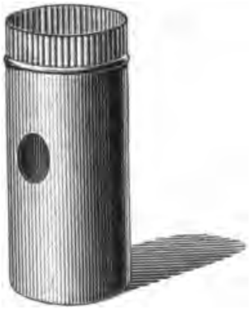

Fig. 4

13. Testing Eggs on the Farm.—It is especially desirable that all eggs sold during the summer should be tested, which can be done on the farm in the same way that eggs are tested for fertility. By candling his eggs at home, the producer gets a good idea of their quality and is in a position to insist on a full price for them. As has been said elsewhere, the light from a lamp fitted with a magnifying lens is best for testing purposes. In Fig. 4 is shown a cover for the light used in testing on the farm. This cover may be made of a section of stovepipe, as shown, of a piece of tin, or an old tin fruit can. The only essential thing is that the cover have a hole in it through which the light may shine on the egg. The hole should be a little smaller than the cross-section of the egg.

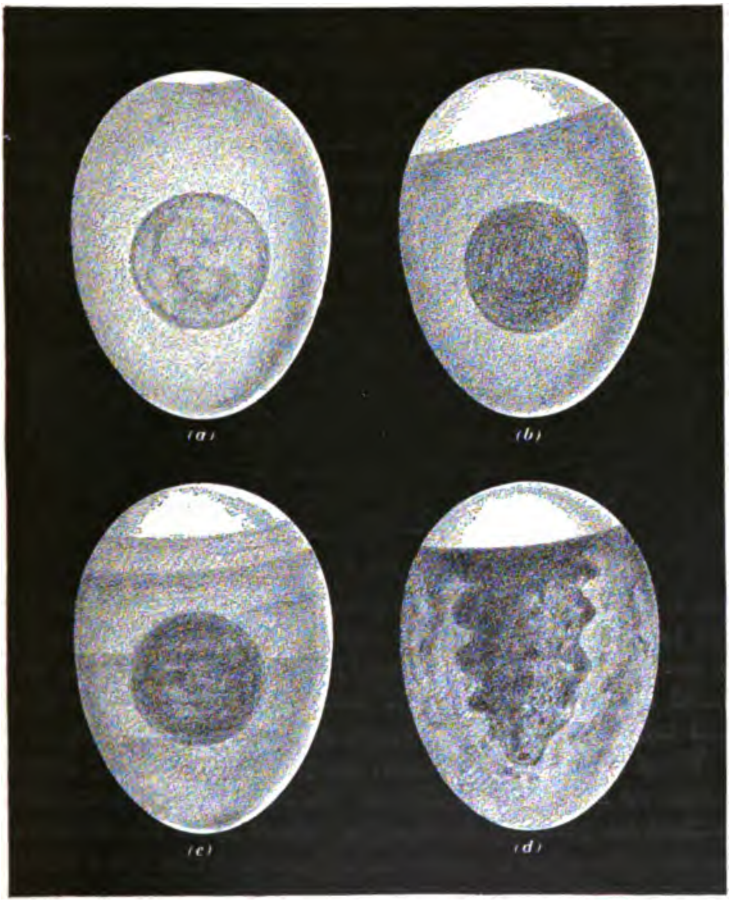

FIG. 5

The age of eggs may also be ascertained by means of a simple gravity test. If fresh-laid eggs are placed in a brine made by dissolving 4 ounces of salt in a quart of water, they will sink below the surface but will not quite rest on the bottom of the vessel. Eggs about three days old will float nearer the top, and eggs that are a week or more old will rise to the surface. The older the eggs the larger will be the amount of eggshell exposed above the surface of the water.

14. Conditions that Decide Grading.—The freshness of an egg is judged largely by the size of the air cell. The eggshell is entirely full when laid, but as the egg cools and its contents contract the air cell begins to form between the two membranes that line the inside of the shell. When exposed to the air, a certain amount of evaporation of the contents of the egg takes place and the air cell increases in size. The size of the air cell in fresh eggs and in eggs that have been well cared for will be small, and fresh eggs should appear clear and bright and free from spots, as shown in Fig. 5 (*a*).

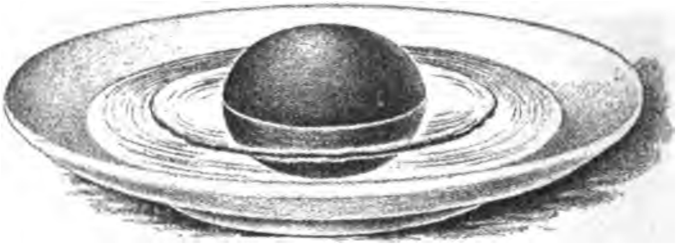

Fig. 6

When broken into a saucer, the yolk of a fresh egg should stand up as shown in Fig. 6. Blood spots are frequently noticed on perfectly fresh eggs. These spots are deposited on the yolk when it passes from the ovisac into the oviduct, their presence being due to the rupture of a small blood vessel in the ovisac, and the blood is enclosed with the yolk by the albumen. While unpleasant to look upon, the blood really does no harm and the quality of the egg is not injured. The white of new-laid eggs is dense and elastic, and where it joins the yolk it is almost solid.

15. Under continued exposure to heat, the contents of eggs will evaporate to a greater or less extent, and the eggs will appear as shown in Fig. 5 (*b*). Such eggs are known as **shrunken eggs.** In contrast with the clear appearance of the fresh egg, the white of the shrunken egg is not clear and the yolk shows heavy through the shell.

When a shrunken egg is broken and turned into a saucer, the yolk lies flat, as shown in Fig. 7. The greater portion of eggs that are sold are more or less shrunken.

A large air cell should not always be accepted as an indication of age. As eggs cool, the contents contract; when the eggs are again heated the contents expand, evaporation is quickened and further shrinkage enlarges the air cell. This, however, may be found sometimes with eggs only a few days old, exposure to heat giving them large air cells. When shrunken eggs are roughly handled, the membrane may be broken and the entire contents of the egg mixed with air. When this occurs, the albumen weakens and assumes a watery appearance and the eggs are known as watery eggs. Eggs in this condition will not stand up when beaten, and for this reason are not very good for baking purposes.

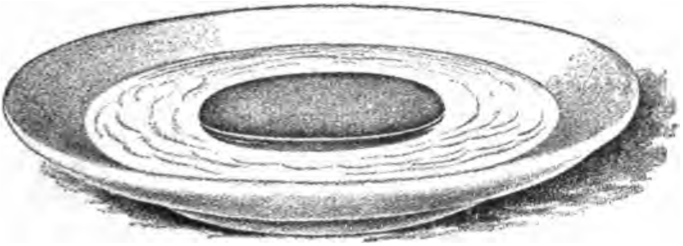

Fig. 7

A watery egg is shown in Fig. 5 (*c*). Although watery eggs are suitable for scrambled eggs and for omelets, they are strongly discriminated against in the market. Watery eggs are plentiful in lots of eggs gathered in the late summer and held for higher prices in the fall. Such lots of eggs are nearly always exposed to more or less heat and frequently are kept in moist cellars. Moisture, as has been shown, predisposes the eggs to decay and when such eggs are shipped, they frequently become worthless in transit.

16. The appearance of a **rotten egg** is shown in Fig. 5 (*d*). The yolk is mixed with the white and the entire contents of the egg is decayed.

Eggs that are soiled or stained from any cause and eggs that have been badly washed in an attempt to clean them are graded as **dirties.** The market value of these is low. There are three causes for dirty eggs, all of which may be corrected by the producer: (1) Filthy nests, in which the eggs are soiled with excrement from the hen; (2) nests in which the straw is damp, thus staining the eggs; (3) breaking of eggs in the shipping case. Although loss from the cause last named cannot be wholly prevented, it can be considerably lessened by not packing thin-shelled eggs and eggs that are cracked or broken.

17. Grading for Immediate Sales.—Grading for immediate sales differs materially from that for storage purposes. When grading for immediate sale, the number of grades is according to the prices quoted in the market reports of the locality in which they are to be sold. Fancy, fresh, dirty, check or cracked, and storage eggs are the five common gradings; in fact, these are the only grades in which the general producer is interested. Eggs that come from short distances, or near-by eggs, are, however, frequently graded as near-by fresh-gathered extra firsts and firsts, according to appearance. Fresh-gathered eggs that come from distant places may be graded as firsts, seconds, and thirds, according to their freshness and general appearance. Fresh-gathered firsts sell at from 4 to 10 cents per dozen more than thirds of the same class, the difference in price depending mainly on the difference in freshness of the different grades. The importance of the daily gathering and shipping of the eggs is hereby emphasized.

18. Fancy Hennery Eggs.—Eggs that go directly from the farm to the market are usually sold as **fancy hennery eggs,**

and are really the best grade of eggs sold. Except in the quotations' from the Boston market, this grade of eggs is rarely mentioned in the market quotations. However, regular shipments of fancy hennery eggs go frequently into the New York market and into the other markets. Eggs of this grade are not generally sent through the regular trade channels; the greater part is sold direct to dealers, who willingly pay a price that is well in advance of the regular market quotations for fresh-gathered extra firsts. To be accepted as fancy hennery eggs, they must be strictly fresh, all of one kind, of even size, of pleasant flavor, and must reach the market within 48 hours after being laid. There is always a ready demand for them, but there are seldom enough eggs of this kind to keep the market fully supplied.

19. Loss of Eggs.—Much loss is occasioned by eggs becoming overheated for a considerable length of time. Fertilized eggs will be spoiled by chick development if they are held for 36 hours at a temperature of 90° F. The entire contents of eggs so exposed are darkened and the developing embryo is plainly visible. Chick development also takes place in eggs that are long exposed to a temperature of more than 70° F. To avoid loss from chick development during warm weather, the eggs must be gathered frequently and be kept in cool places. Infertile eggs, of course, will not be spoiled by chick development, but they will become shrunken when exposed to heat; hence, it is advisable to care for them in the same way. Clear eggs taken from an incubator or from a sitting hen are fit for food unless the yolk has become broken. Such eggs, of course, should not be sold as new-laid eggs.

The loss from the heating of eggs is especially great in warm climates. Indeed, it is stated that in Texas the egg business is at a standstill from the middle of June until cool weather in the fall. In prolonged spells of hot weather throughout the region west of the Mississippi, it is by no means uncommon to find hatched chickens in egg cases. Such occurrences, of course, can be prevented by properly gathering, packing, and caring for the eggs.

The loss from rotten eggs is small when compared with that of shrunken eggs. Comparatively few eggs decay after reaching the market, the greatest loss from this cause being on the farm from fertilized eggs. Eggs are especially liable to decay if they are cooled and then become heated in a damp, musty place.

TABLE III

PERCENTAGE LOSS OF TOTAL EGG CROP

Class	Per Cent.
Dirty eggs	2
Broken eggs	2
Chick development	5
Shrunken or held eggs	5
Rotten eggs	2½
Moldy and bad-flavored eggs	½
Total	17

If a rotten egg becomes broken in a case of good eggs, the contents of the entire package are lessened in value.

20. The per cent. of loss of the total egg crop of the United States from various causes is shown in Table III, which is adapted from a bulletin published by the United States Department of Agriculture.

PRESERVATION OF EGGS

COLD STORAGE OF EGGS

21. Reason for Storage of Eggs.—As a result of the development of cold storage, eggs that would otherwise decay and become a total loss are kept for a long time in a good condition for food. By the use of cold storage, all kinds of poultry products are kept over from the season of plenty to that of scarcity. Cold storage, by tending to keep prices uniform throughout the year, benefits producer and consumer alike. When eggs are most plentiful in spring and would of necessity be wasted, they are bought at competitive prices and are placed in storage to be sold and used when eggs are less plentiful. The greater portion of all eggs placed in storage come from farms in the outlying districts. A quick sale of these eggs is made in the spring, because they are most abundantly produced then and can at that time be profitably collected and stored. In the late summer and fall, the production of eggs in these districts falls off very much and but little if any account is made of the few eggs produced.

22. Condition of Storage Eggs.—Storage eggs do not at any time compete with fresh-laid eggs or with fancy hennery eggs. These fancy grades stand alone and their value is regulated entirely by the local supply and demand. When eggs fit for storage can be bought in New York for 21 cents, fresh-laid eggs usually sell at 24 cents; and when storage eggs are sold in a time of scarcity for 25 cents, fresh-laid eggs may bring from 40 to 45 cents per dozen. The impression that storage eggs are bad eggs is an erroneous one; they may be shrunken, as are three-quarters of all the eggs sold; but seldom, if ever, is a storage egg different on being taken from storage than when it was placed there. With proper cold storage, eggs may be kept indefinitely, and the bad effects of careless handling after they are taken out of storage should not be laid to cold storage.

23. Care of Eggs in Storage.—Eggs intended for storage must be selected with care and must be packed in clean cases. When so selected and packed and kept at temperatures that range from 29° F. to 34° F., very little, if any, change takes place in the quality of the eggs. While in storage, they should be protected as far as possible from air circulation, as this increases evaporation and causes the eggs to shrink. On removing the eggs from storage, they should be kept at a temperature not warmer than 42° F. until exposed for sale. As has been said, when it becomes necessary to expose the eggs, it should be done gradually in order to avoid sweating.

The air in cold-storage houses should be free from moisture and bad odors of any kind. The yolks of eggs kept long in storage at a temperature of 32° F. settle to one side of the egg, unless the eggs are occasionally moved about. At temperatures lower than 32° F., the eggs become more or less solid and do not require turning. The interior of a cold-storage-egg room is shown in Fig. 8. Large as the system of cold storage now is, it could undoubtedly be greatly extended in many districts.

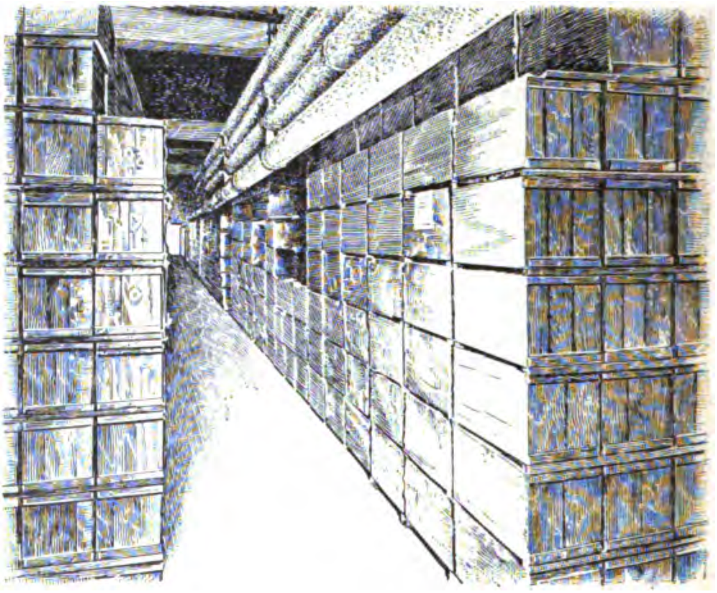

Fig. 8

PICKLING OF EGGS

24. Method of Pickling Eggs.—In Denmark, large quantities of eggs are preserved each year in pickling tanks, which are shown in Fig. 9. These tanks are built in cool, underground cellars, and each tank has a capacity of many thousands of eggs. The eggs are preserved either in lime water or in water glass; lime water, on account of its cheapness, is most frequently used. One objection to the use of the lime water is that it hardens the eggshells. Eggs for pickling are most carefully graded as to freshness, size, shape, and weight. In preparing eggs for pickling, they are first placed in trays holding 120 eggs each, as shown in Fig. 10. All eggs of different sizes go into different trays, the weights of the eggs in trays ranging from 15 to 18 pounds. When filled with eggs, the

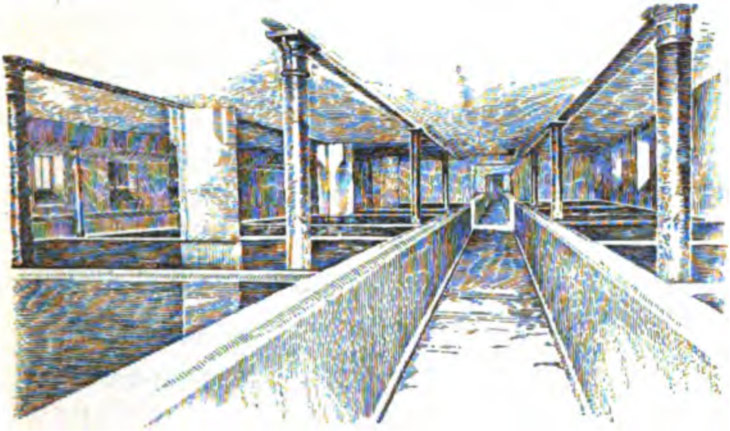

Fig. 9

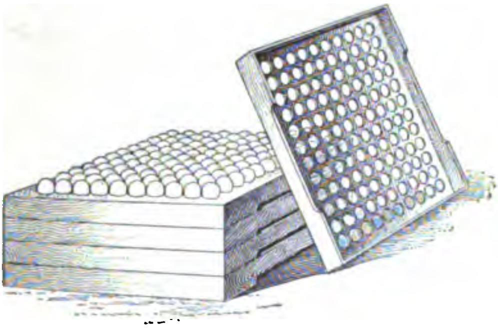

Fig. 10

trays are taken into a dark room and placed over a candling box on which the eggs are candled in a wholesale fashion.

The candling box is made of wood and is lined with polished tin that reflects the light. On the bottom of the box are electric lights. In candling, the tray filled with eggs is placed on the box above the lights. The light shines up through the eggs, and defective ones are readily detected and removed, their places being filled with sound eggs. The tanks are nearly filled with eggs, which are then covered with the preserving solution. This work, of course, takes place in the spring, usually in April or May, and the eggs are removed and sold in the fall. The tank cellars are cool, well ventilated, and special pains are taken to keep them clean and free from bad odors.

25. Care and Sale of Pickled Eggs.—When ready to be sold, the eggs are taken from the tanks by means of wire scoops, placed in wire trays, thoroughly washed in running water, and dried in currents of air. After being dried, the eggs are packed in cases, each case containing eggs of uniform size, and the weight of the eggs, which may be 15, 16, 17, or 18 pounds to the 10 dozen, being plainly marked on each case. Most of the eggs pickled in Denmark find a sale in the markets of England.

There seems to be a preference in European countries for limed eggs over cold-storage eggs. The same is not true in other countries where cold storage has been most successfully carried on. There is no means of turning eggs in pickle, and no matter whether lime water or water glass is used, there is more or less coating left on the shell. Limed eggs or eggs kept in any kind of solution are apt to be watery inside the shell. There is scarcely any evaporation of eggs in pickle, but many of the eggs do admit moisture inside the shell. Eggs sent from the pickling vats as described, sell at not much less in European markets than other imported eggs. In America, limed eggs usually sell for less than storage eggs. All kinds of eggs stored in solutions are graded as limed eggs in American markets.

PACKING OF EGGS

26. Standard Egg Cases.—Eggs that are sent long distances either by freight or express arrive at their destination safely when packed in cases properly made for the purpose. The egg exchanges in various markets require that all eggs shall be packed in clean, whitewood cases that hold 30 dozen eggs each, unless otherwise specified. The type of case most commonly used is shown in Fig. 11. The case itself is made of whitewood, and the flats *a* and the fillers *b* are made of No. 2 strawboard. Excelsior for packing is shown at *c*. A thin layer of excelsior is placed on the bottom of the case, and on this is placed a flat, then a filler in which the eggs are placed small end down. A flat is placed between the fillers, and enough

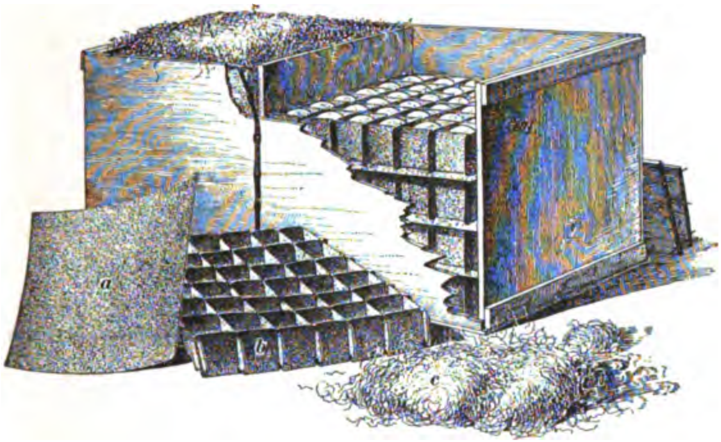

Fig. 11

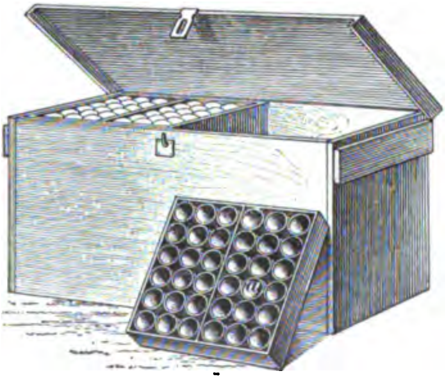

Fig. 12

excelsior to insure a moderately tight fit is placed between the eggs and the cover. The egg exchanges require that only clean, dry fillers and kiln-dried excelsior be used.

27. Patent Egg Cases.—In many localities patent egg cases are used in the shipment of eggs. One type of patent case is shown in Fig. 12. Like the standard case, this case ordinarily has a capacity of 30 dozen eggs. The slots *a* in the patent egg-case filler are round, however, thus lessening the loss from breakage. The fillers are so arranged that one layer of eggs cannot press directly on any other. The patent egg case is used in the direct marketing of eggs and is usually returned to the shipper. The lid is supplied with hinges and a hasp that holds it in place when closed.

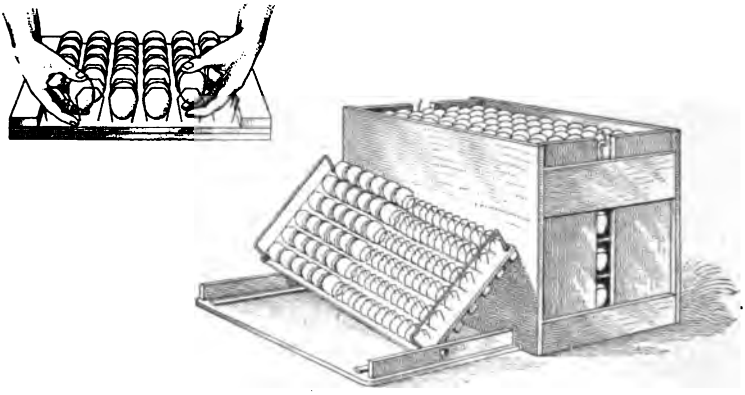

Fig. 13

Another type of egg case shown in Fig. 13 is equipped with fillers or trays, the slots of which are constructed of wire, and made so that when they are fitted into the case it is impossible for the eggs to come in contact with one another. When cases of this kind are exposed to wet or dampness, the wire in the fillers will rust, and if these fillers are carelessly handled the slots are liable to get bent or broken. The wire egg case is handy in some cases for the retail trade, but they are seldom used in selling to commission houses.

28. Paper Cartons.—The use of paper cartons in the delivery of eggs for the retail trade is yearly becoming more common. They are of special use in supplying the first-class trade. Both storekeeper and customer prefer cartons to the standard egg crate, provided the eggs in the cartons are of first quality. Although the use of paper cartons improves the appearance of the product, it must be emphasized that no package, however excellent, will make bad eggs good. In Fig. 14 are shown two common types of cartons, also a package of fifty as they are shipped by the maker. Of course, any brand or advertisement may be printed on the carton. The cost of cartons is slight compared with the additional price at which eggs sell when packed in them.

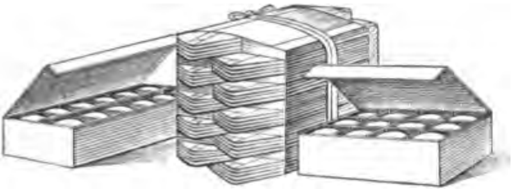

FIG. 14

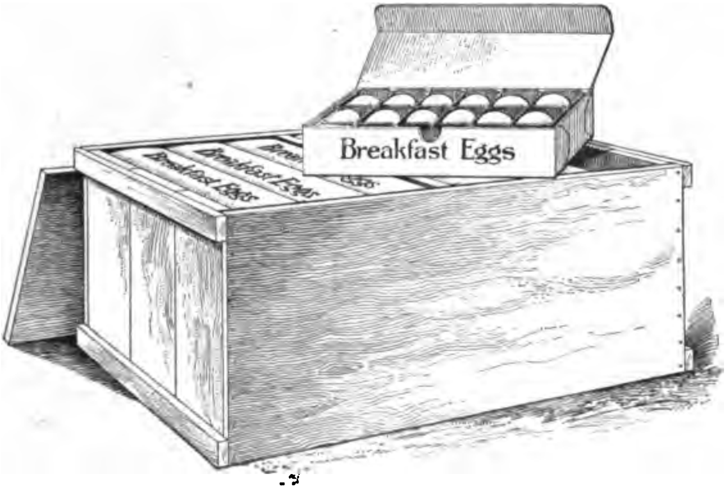

FIG. 15

Wooden cases are used for shipping eggs in cartons. These cases can be made of any desired size; the one shown in Fig. 15 holds twenty-four cartons, each of a capacity of a dozen eggs. The case should be well made and so shaped that the cartons fit closely without moving about. As the outward appearance of the package has much to do with the sale, the cases should look attractive; while it is possible to sell a poor product well packed, it is almost impossible to get a high price for a good article poorly packed. White-shelled eggs should be packed in blue-paper cartons, while brown-shelled eggs should be packed in white cartons.

Cartons should be fresh and clean when used. It is inadvisable to use those that are shelf-worn or dirty, as the choice of the housewife is influenced largely by the appearance of the egg package. The cost of printed cartons ought not to exceed 1 cent each, and by their judicious use it is possible to secure an advance of several cents per dozen in the price of the eggs.

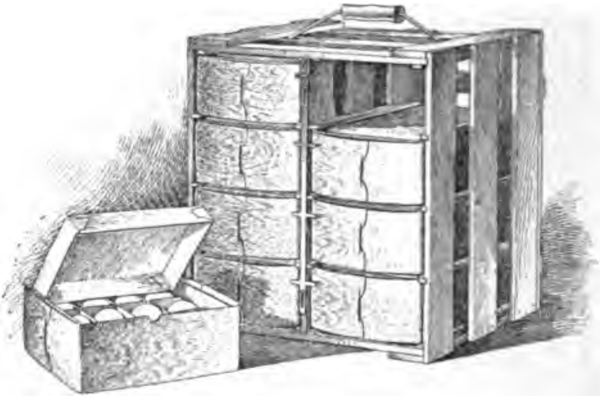

Fig. 16

A package well suited for the hand delivery of eggs is shown in Fig. 16; this case has a capacity of eight cartons. For the delivery in person of eggs of fine quality, such a package is a convenience to the seller and an attractive means of displaying his wares.

Another attractive way of displaying eggs is to place them in a tray or basket, as shown in Fig. 17. When carefully selected eggs that have the bloom of freshness on their shells are displayed in this way, their quality will be evident.

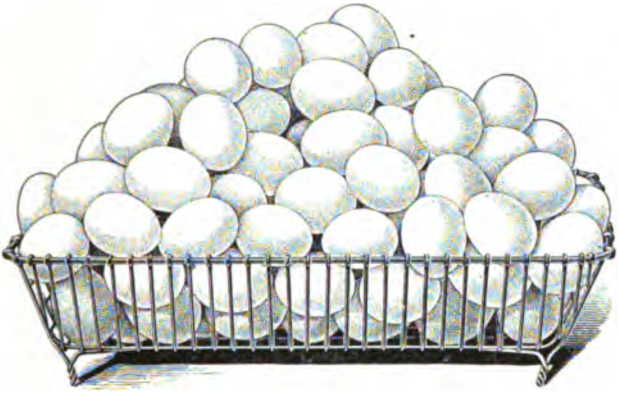

FIG. 17

THE SELLING OF EGGS

QUALITY OF STORAGE EGGS

29. Necessity for Intelligent Handling.—The consumption of eggs, large as it is, could be doubled in many localities if good eggs could always be obtained. In many places the fact that eggs are not considered fit for food during hot weather greatly reduces their consumption. This opinion is largely due to the poor methods used in handling, transporting, and storing the eggs. Much complaint on account of poor storage eggs could be avoided if the eggs were properly handled after they were taken out of storage. After eggs are taken from storage, they are frequently exposed to a temperature of more than 80° F. Under such conditions the cases should be left unopened for 24 to 36 hours or more, in order that the eggs may be gradually warmed and not suddenly exposed to the warm air. When cold-storage eggs are suddenly warmed, moisture from the air gathers on their shells and passes through the pores, opens or spreads the membranes inside the shell, and permits the germs of decomposition to enter.

If the eggs are permitted to warm through gradually before the cases are opened, they are not so liable to gather moisture as when the cases are quickly opened and their contents exposed to the warm air. It matters not how good the eggs may have been when they were stored, their value soon disappears if they are allowed to sweat. Eggs exposed for sale in warm places may be damaged by heat and flies, and if long exposed, the germs within the eggs may start to grow. Cleanliness and proper care has everything to do with the edibility of eggs.

The position of the consumer is one of helplessness, and he must accept the product offered to him or decline the use of eggs as food. From this cause, the consumption of eggs is not so great as it should be, and it is only a question of care and proper methods to increase greatly the market demand for eggs.

The quality of the eggs on the different markets of the world varies greatly. Only a relatively small portion of the eggs gathered and sold in the American markets would find a sale in London, and yet eggs are sent from Ontario and Australia to London, where they find a ready sale in competition with eggs produced at home. Through the practice of the methods of gathering eggs in Australia and in the transporting of them to London, much could be saved by the American farmer, and the interests of the consumer would at the same time be bettered.

EGG PRICES

30. Market Quotations of Eggs.—The average wholesale price of eggs in the New York market is shown in Table IV, which gives a 3-year average of the price paid each week prior to 1907 for near-by fresh eggs.

The great difference in value between the ordinary grade of eggs and fresh eggs will be seen by referring to Table V, which gives the average monthly wholesale price for all grades of eggs and for strictly fresh eggs in the New York market prior to 1907. In order to get the top prices, the matter of vital importance to the poultryman is to make his product equal to that of the best on the market. As has been said, this is largely a question of cleanliness, proper feeding, care in handling, and the practice of the right methods in marketing.

TABLE IV

MARKET PRICE OF EGGS

Month	Per Dozen			
	First Week Cents	Second Week Cents	Third Week Cents	Fourth Week Cents
January	32	30	29	30
February	29	28	30	23
March	23	23	17	17
April	18	17	17	18
May	18	18	18	18
June	18	19	19	19
July	19	19	21	21
August	21	22	23	23
September	24	24	24	24
October	25	25	25	26
November	29	30	33	33
December	32	32	34	33

Summing up, it may be said that, as a rule, freshness governs the price paid for eggs. Near-by-laid eggs may be selected on account of their outward appearance, but excellent outward appearance is not received as an absolute guarantee of first quality; eggs may look well and fail in flavor. Appearance of the eggs and the past record of the producer are the factors that are accepted as a guarantee of quality.

TABLE V

COMPARISON OF MONTHLY AVERAGE PRICES OF EGGS

Month	Average Price for All Grades Cents	Average Price for Strictly Fresh Eggs Cents
January	25.8	42
February	24.5	40
March	19.3	32
April	16.9	30
May	16.6	31
June	15.5	32
July	15.6	35
August	17.7	38
September	20.7	40
October	21.4	42
November	26.0	45
December	27.7	42

31. Markets of the World That Govern Egg Quotations. The market quotations for eggs throughout the world are governed largely by the prices paid in the densely populated centers. New York, Boston, and Chicago make the prices for America, and London, Manchester, and Berlin make the prices for Europe. Eggs are quoted by the dozen in America, while in London the quotation is by the long hundred (120). Eggs are designated in the London market according to the locality from which they are sent, and as this is, to a certain extent, an indication of their freshness and quality, it has an influence on the quotations. The highest quotations are for the best English eggs, which are fully equal to fancy hennery eggs in America; and French, Danish, and Italian eggs will grade with near-by eggs and eggs for storage in America. The best of the eggs that are sent from Ireland to London sell for English eggs, and the rest sell for lower prices. Russian eggs grade about the same as shrunken and ungraded eggs in the New York market.

A comparison of prices in the New York and London markets is shown in Table VI, which gives the quotations in the two markets for the month of May, 1909. As the English shilling is equivalent to 24⅓ cents in American money and a penny is equivalent to 2 cents, the first London quotation of 8/4 to 9/2 for 120 eggs, or 10 dozen, is about equal to 20 to 22 cents per dozen. The quotations given cannot be accepted as a guide for the selling price of eggs, but they furnish an approximate indication of the relative selling prices in New York and London. It will be noted by comparison that the New York prices are about 10 to 12 per cent. higher than the London prices. The fluctuations of prices in both markets at different seasons of the year are about the same.

TABLE VI

NEW YORK AND LONDON QUOTATIONS

Kind of Eggs	New York Prices per Dozen Cents	Kind of Eggs	London Prices per 120 Eggs Shillings and Pence
Fancy hennery......	25	English	8/4 to 9/2
Near-by fresh.......	23	Irish	7/6 to 7/10
Fit for storage	23	French	8/3 to 8/9
Brown and mixed ...	22	Danish	8/3 to 9/6
Shrunken...........	21	Italian	8/0 to 8/6
Ungraded and soiled	19	Austrian	7/3 to 8/6
		Russian	7/0 to 7/3

METHODS OF SELLING

32. Channels for the Sale of Eggs.—There are many ways in which eggs are sold, but the five main channels through which the producer disposes of his product are: (1) Trading to the country store for merchandise; (2) selling to egg collectors; (3) selling through commission houses; (4) selling through cooperative organizations; (5) selling direct to the consumer.

33. Trading Eggs and Selling to Collectors.—Perhaps the channel most generally used is the **trading of eggs for merchandise.** Where this method is practiced, there is little, if any, incentive for the producer to give his product the proper care or to get it to market while entirely fresh and in prime condition. If the system of selling for cash were to become general, it would result in an improvement of the quality of the eggs offered and an increase in the price received. The buyer would demand the best eggs for the highest cash price, and the highest cash price would be an incentive for the producer to get the eggs to market quickly and in the best condition.

In many sections of the country the practice of **selling eggs to collectors** is in vogue. These collectors gather the eggs from near-by farms, grade them, and dispose of them to regular customers or to retailers or commission houses.

34. Selling Eggs Through Commission Houses.—The least trouble will be experienced in **selling eggs through commission houses** and thus dealing directly with those that make a specialty of the egg business. There are many houses that make a specialty of the trade in select breakfast eggs, and such houses are able to obtain the highest market price for good eggs. As commission houses are paid on a percentage basis, it is to their interest to obtain the highest prices.

Producers that have gained a reputation for first-class goods can often demand a premium price for their eggs, and such a price is paid willingly whenever the quality of the eggs warrants it. Eggs sent to commission houses should always be well packed. The practice of packing the case with stale eggs and topping it with one or two layers of fresh eggs assures the sale of the entire lot at the price of the poorest. It is always advisable to pack the good eggs in cases by themselves, and put the poor eggs in other cases. By proceeding in this way, fair prices will be obtained for all the eggs offered.

35. Selling Eggs Through Cooperative Organizations.—The apple crop of the United States has an annual value of about $60,000,000. The value of the eggs produced each year is at least five times this amount; yet more than ten times the effort used to sell the egg crop is put forth to market the apple crop. This disparity of effort is largely a result of a misunderstanding of conditions affecting both crops. When these conditions are well understood, greater attention will doubtless be given to the marketing of both crops. When safely gathered, the total value of the apple crop is less than that of the eggs wasted. Much of the waste in eggs can be avoided by intelligent cooperation through an organization. In this way, not only will financial loss be avoided, but the consumer will be furnished with a better article of food.

To achieve satisfactory results in **selling eggs through cooperative organizations,** the producer, the collector, the small dealer, and the commission house must work together for mutual benefit. Cooperation may be successfully carried on by an association of individuals, by an organization composed of branch societies, or by the united efforts of producers and private packing firms. In localities where cooperation has been most successful, the objects of the organizations have been the improvement of quality, the proper care of eggs from the moment of laying, the reduction of loss in gathering and shipping, and the prompt remuneration of its members. In the practice of these organizations, collectors gather the eggs from the producers at stated intervals. Each collector is made responsible for loss through breakage or short weight. Each member of the organization stamps his number on his eggs prior to their delivery to the collector, who pays for the eggs as they are delivered to him. The eggs are weighed as well as counted, and careful record is kept of the number and weight of eggs furnished by each producer.

36. The rules governing the members of the association require: (1) that the eggs shall be gathered each day and during hot weather twice a day, and that they shall be kept in a cool place; (2) that no other eggs than those laid by hens belonging to the member shall be delivered by him to the collector; (3) that the nests shall be kept clean, and that a fine shall be assessed on the member for the delivery of stale, stained, or tainted eggs, or for a failure to comply with all the rules of the association; (4) that all eggs produced by the member, except those used for hatching or for home consumption, must be delivered to the collector.

The expense of collecting the eggs is borne by the local organization. The eggs are sent from the gathering station to the packing station, where they are sorted and graded for size and quality. The total loss in many instances is less than 5 per cent. of the eggs handled. The eggs received at the packing station are disposed of quickly, being either sent immediately to market or stored in vats in cellars similar to the one shown in Fig. 9.

Where cooperation has been practiced for years, the quality of the eggs handled has continuously improved; the prices received have also advanced, and the per cent. of loss has been reduced to a minimum. After the eggs have been marketed by the packers and all expenses paid, each member of the organization receives his share of the profits. Each member's share is, of course, based on the value of the eggs produced by him. Under cooperation of this sort, both producer and middleman prosper. The main difficulty in an organization of this sort is that of holding it intact until it has been given a fair trial.

37. A similar kind of cooperation is often practiced in egg-producing neighborhoods. In cooperation of this type, each member, in turn, acts as collector. The eggs should be collected daily and should be sold within 48 hours after collection. By this means, good market prices may be obtained and but little if any loss sustained. As a result of neighborhood cooperation, better quality will be maintained and each cooperator, as well as the whole district, will be benefited. The better and fresher the eggs of a district, the more anxious will be the trade to secure them.

38. In order to make cooperation successful, stringent rules must be observed by the producers. The eggs must be gathered frequently and special attention must be paid to cleanliness of shell. Hidden nests or nests that are filthy cannot be tolerated. Broody hens must not be allowed the use of nests in which other hens lay, nor can the interior of poultry houses be permitted to become damp or infected with disease. Grading for size must be carefully practiced, because small eggs will not sell for more than one-half the price of those that weigh 2 ounces or more. Uniformity in size, shape, and color have much to do with the price of eggs.

Eggs of large size are not worth much more than eggs of normal size. If large eggs are placed in a case with other eggs, they are apt to get broken and injure the appearance of the case. Two-ounce eggs should be produced as far as possible. Uniformity of size in eggs can be established by the practice of the principle expounded in *Laying Hens*. Two-ounce eggs fit without crowding or without being too loose in the ordinary egg cases. Eggs uniform in color and shape will sell for more than those of mixed color, even if they are uniform in size. No matter whether the eggs produced on the farm are brown, white, or mixed in color, each color should be packed separately.

39. Selling Eggs Direct to Consumers.—Whenever location and other conditions are suitable, more profit may be derived by **selling eggs direct to consumers** than by any other method. Prices are always highest when the quality and appearance of the eggs are the best. In direct selling by the producer to the consumer, much time is expended in soliciting trade and in the delivery of the goods. Customers are always insistent on the best quality and prompt service at regular intervals.

The most satisfactory trade of this kind can be had with large retail dealers that sell to a trade willing to pay for the best, and with clubs, hospitals, and restaurants that cater to customers who pay high prices. Establisments of this sort do not buy quickly when first solicited, but when once their custom has been obtained through a first-quality product, they rarely change as long as the eggs furnished continue to suit.

MARKET POULTRY

(PART 1)

COMMERCIAL QUALITIES OF POULTRY

FOOD VALUE OF POULTRY

1. The term **market poultry,** as commonly used, is applied not only to domestic fowls but also to turkeys, ducks, guinea fowls, pigeons, water fowls, and wild birds of various kinds placed on the market for sale as food. Although this application of the term will answer for general purposes, the different groups of market poultry are too widely separated to permit of their consideration together. In the discussion of the subject here, therefore, the term market poultry will refer only to domestic fowls—cockerels and pullets, which are correctly called chickens, and cocks and hens, which are loosely termed chickens.

Poultry is graded for the market in much the same way as eggs. In fact, poultry is more easily graded than eggs for the reason that the correct conclusion as to quality may be more quickly drawn from surface indications.

2. Digestible Food Principles in Poultry Flesh.—The United States Department of Agriculture and several other organizations have conducted a number of experiments to determine the nutritive value of various foods, with the special object of learning how thoroughly the flesh of fowls and other poultry products are digested. For instance, several digestion experiments were carried on at the Maine Agricultural

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Experiment Station, in which poultry formed a part of the diet, and the results of these tests were compared with the results of others in which chicken was replaced by beef. From all the available evidence, it seems fair to assume that poultry flesh is as thoroughly digested as that of other domestic animals commonly used for food. As a result of a large number of experiments made in many different parts of the world, it is believed that on the average 97 per cent. of the protein, 95 per cent. of the fat, and 98 per cent. of the carbohydrates present in fish and meat of all kinds is digested. These values may, therefore, be assumed to represent the digestibility of the flesh of poultry until more evidence is at hand. In calculating the quantity of nutrients furnished by different foods, it is common practice with many American investigators to use the factors just quoted for animal foods. They are somewhat larger than the corresponding factors for vegetable foods, which are 84 per cent. of the protein, 90 per cent. of the fats, and 97 per cent. of the carbohydrates. In other words, animal foods, including poultry and fish, are, generally speaking, considered somewhat more digestible than vegetable foods.

3. It is easy, when the chemical composition of any food is known, to estimate the amount of digestible nutrients it contains by using the factors just given for animal and vegetable foods. In Table I is shown the composition and fuel value per pound of various classes of poultry and some other foods. As will be seen, poultry compares favorably with other flesh foods.

4. Comparison of Poultry and Other Meats.—When the meat of poultry is compared with beef, veal, lamb, and pork, it is found that on the average the refuse in poultry is slightly in excess of that in other kinds of meat. On the average, the various kinds of poultry furnish not far from 5 per cent. more protein and a little more ash than do the other kinds of meat included in Table I. On the other hand, the poultry meats most used—chicken and fowl—contain relatively little fat and have a relatively small fuel value. So far as the nutritive

TABLE I

COMPOSITION OF POULTRY AND CERTAIN OTHER FOODS

Kind of Food	Refuse Per Cent.	Indigestible Nutrients Per Cent.	Water Per Cent.	Protein Per Cent.	Fat Per Cent.	Carbohydrates Per Cent.	Ash Per Cent.	Fuel Value per Pound Calories
Chicken: As purchased......	18.8	0.9	55.5	17.3	6.8		0.7	749.85
Edible portion.............		1.2	68.4	21.2	8.4		.8	921.71
Fowl: As purchased.........	25.2	1.0	47.3	14.0	12.0		.5	880.89
Edible portion.............		1.7	59.5	19.8	18.2		.8	1,297.66
Turkey: As purchased.......	14.3	1.9	49.2	18.4	15.4		.8	1,142.08
Edible portion.............		2.2	57.4	21.5	18.0		.9	1,334.72
Duck: As purchased.........	15.9	1.8	51.4	14.9	15.2		.8	1,039.97
Edible portion.............		2.0	61.1	17.8	18.1		1.0	1,239.91
Goose: As purchased.........	11.1	1.5	48.0	14.4	24.2		.8	1,406.25
Edible portion.............		1.8	54.0	16.1	27.3		.8	1,582.52
Miscellaneous foods: Beef, sirloin steak, as purchased..	12.8	1.2	54.0	16.0	15.3		.7	1,073.63
Halibut, fresh steaks, as purchased..................	17.7	.7	61.9	14.8	4.2		.7	573.26
Eggs, as purchased.........	11.2	2.3	65.5	11.5	8.8		.7	679.00
Milk.....................		.6	87.0	3.2	3.8	4.9	.5	334.85
Wheat bread, white		3.4	35.6	7.9	1.1	51.1	.9	1,184.98
Potatoes, as purchased......	20.0	.9	62.6	1.5	.1	14.3	.6	303.82

value alone is concerned, the general advantage of poultry over the other meats thus appears to be that, pound for pound, it contains a trifle more of the building materials needed by the body; its disadvantage is that it furnishes less of the energy-giving materials than the fatter meats.

In general, the light-weight birds are richer in protein and poorer in fat than the others. Probably in all the light-weight varieties, at any rate in chickens, the young birds yield a larger proportion of protein and a smaller proportion of fat than the older ones of the same kind; while in the heavy-weight varieties, the young are richer in fats and poorer in protein. As a general thing, the young birds contain less refuse, which means that the proportion of total bone weight is smaller. Their flesh also contains more water, which indicates that it is not so solid and compact as in the older birds.

MARKET QUALITIES OF POULTRY

5. Relation of Quality to Price.—The true value of quality in market poultry does not seem to be generally appreciated by the producer. This condition is somewhat peculiar, for the producers of beef, mutton, and pork appear to make every effort to furnish a product that fulfils all the demands of the market in which it is sold, while the poultryman, on the other hand, too often supplies a product that comes far both from satisfying the demands of the consumer and from meeting his own expectations.

Producers of the larger animals for market know full well that the returns they receive depend largely on the health, quality, and condition of the animals they market, and that animals that are thin in flesh, being largely offal, consequently sell at a small price. The foregoing statement is true of poultry to an even greater degree than of other farm animals, because of their naturally greater percentage of waste.

6. The demand in the poultry market is for the best, and all lines of market poultry are graded according to their selling value. One grade of poultry frequently sells in the open market at a price as low as 7 cents a pound, and in the same market and on the same day other grades of market poultry will bring 30 cents or more per pound. The low-priced grades may consist of three-quarters bone and offal and may be but little sought after, but the high-priced grade will sell quickly and the demand for it will probably be unsatisfied. Moreover, a much greater profit may be derived from selling a few specimens of the best grade than from selling ten times as many of the poorer grade. In fact, little or no profit is obtained in the sale of the lower grades of market poultry.

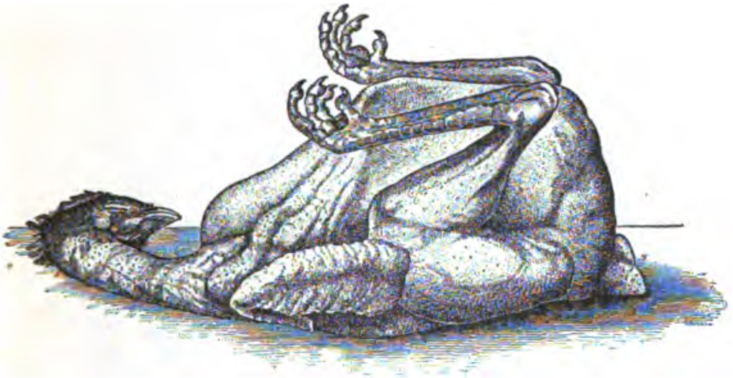


FIG. 1

7. Indications of Quality.—The market requirements call for a fowl a large part of which is good table meat. The edible portions must be largely in excess of the waste, or offal. The breast must be long and deep and well filled with meat; the less prominent the breast bone, the more desirable the fowl will be for market, but, on the other hand, too much fat makes a waste. A fowl with an excess of shanks, wings, or neck is undesirable because of the large proportion of waste in these parts. Thin or narrow breasts, slim thighs, and backs bare of meat are also undesirable. Fowls that have yellow flesh, skin, and shanks are preferred in American markets, while those with white flesh and skin are favored in

European countries. The flesh of all market poultry should be tender and juicy and should have a pleasant flavor.

8. In Fig. 1 is shown a well-fattened carcass of a mongrel fowl. The best that could be done to fatten such a specimen was done, and yet there is little or no meat on the leg, the thigh, or the point of the breast bone. There is, however, an excess of fat within the abdomen. In general, it may be said of the specimen shown in Fig. 1 that the waste products are in excess and that meat of good quality is lacking.

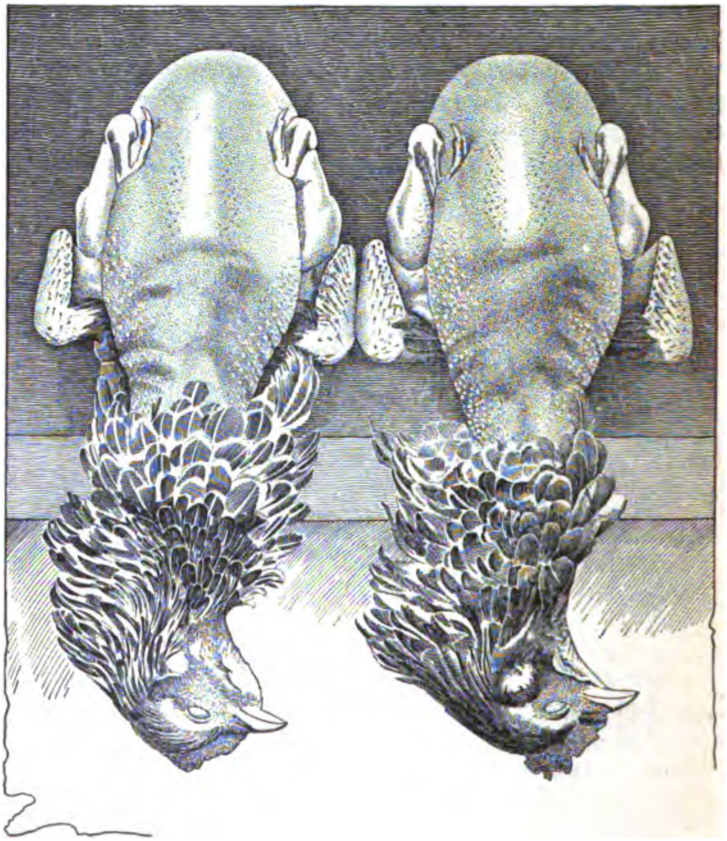


Fig. 2

The dressed carcasses shown in Fig. 2 are typical of good market poultry. In such poultry the point of the breast bone is hidden beneath the meat that surrounds it. Not a spot on the whole framework is bare or uncovered; the wings and thighs are plump, yet there is no excess of fat in the abdomen. Neither is there an excess of feathers, bones, or other waste products.

The type of bird shown in Fig. 1 is the result of raising mongrel fowls, while to produce the kind of birds shown in Fig. 2 demands careful selection and breeding, as well as proper feeding.

9. Importance of Cleanliness.—A market quality of vital importance in poultry is that of cleanliness; dirt and filth detract from the appearance of the carcass and injure its value. The manner in which the birds are plucked has much influence on their appearance in the market. If the work of plucking the fowl is well done, the surface of the skin will be soft and smooth; if it is badly done, the carcass will appear rough and spotted.

TABLE II

LOSS IN DRESSING FOWLS

Kind of Fowls	Number of Birds	Live Weight Pounds	Weight—Bled and Plucked Pounds	Loss Per Cent.	Weight—Intestines, Head, and Feet Removed Pounds	Loss Per Cent.
Cocks	18	127.9	117.9	7.8	97.8	23.5
Cockerels	278	1,773.0	1,577.5	11.0	1,312.0	26.0
Hens	201	1,195.0	1,103.4	7.7	906.3	24.2
Pullets	47	261.1	240.0	8.1	193.7	25.8
Total	544	3,357.0	3,038.8	9.5	2,509.8	25.2

As the valuation of the carcass is based on its appearance, satisfactory returns cannot be expected from fowls that are poorly picked and carelessly dressed. A plump fowl of soft flesh will be made unattractive if the work of preparing it for the market has been done in a slovenly way.

10. Loss of Weight in Dressing Fowls.—On an average, nearly one-third of the total weight of a fowl is lost in dressing and preparing it for cooking. In the case of fowls thin in flesh, the loss is greater than this. The least waste occurs in fowls that have been properly fattened; excessively fat fowls, like those that are poor in flesh, show a large proportion of waste on being dressed.

TABLE III

LOSS IN DRESSING DIFFERENT BREEDS OF FOWLS

Breed of Fowls	Number of Birds	Live Weight Pounds	Weight—Bled and Plucked Pounds	Loss Per Cent.	Weight—Intestines, Head, and Feet Removed Pounds	Loss Per Cent.
Barred Plymouth Rocks	187	1,199.9	1,090.8	9.1	910.4	24.1
White Plymouth Rocks	125	859.1	779.4	9.3	644.7	25.0
White Wyandottes	103	618.2	558.3	9.7	460.8	25.5
Buff Wyandottes	6	39.4	35.2	10.7	28.5	27.7
Rhode Island Reds	18	109.7	98.0	10.7	80.2	26.9
Black Langshans	32	200.5	182.7	8.9	151.4	24.5
Single-Comb White Leghorns	22	88.3	78.0	11.7	62.1	29.7
Rose-Comb Brown Leghorns	35	129.6	116.0	10.5	90.4	30.2
White Wyandotte-Light Brahma cross	16	112.3	100.4	10.6	81.3	27.6
Total	544	3,357.0	3,038.8	9.5	2,509.8	25.2

In Table II is shown the live weight of several lots of cocks, cockerels, hens, and pullets and the loss per cent. in dressing them. This table, which is a result of an investigation at the Storrs Experiment Station, Connecticut, also shows the number of birds used in the investigation and their weights at different stages in the process of dressing. Fowls in all conditions—well fattened, thin, and excessively fat—were used; consequently, the results as given in the table may be considered as applicable to average conditions. In Table III the results of the investigation are tabulated by breeds.

PRODUCTION OF MARKET POULTRY

STOCK FOR BREEDING MARKET POULTRY

11. Qualities Necessary in Stock for Breeding.—In the breeding of market poultry, as in other lines of work, success comes only through ambition and well-directed energy long sustained. Much of this energy must be expended in the selection of the stock to be used in producing the eggs, and the pedigrees of the breeding stock of poultry should be examined as closely as the pedigrees of other farm stock. Breeding stock must possess the essentials of what is desired in the offspring, and the essentials for the production of the best grades of market poultry are **vitality** and **meat-producing qualities.** The kind of breeding stock to select is largely a question of the relative amounts of waste portions and edible meat. The appearance of the breast bone is one of the most important factors in making this selection. When the bone is prominent, the breast is not well covered with meat, and, when dressed, the carcass will not have the attractive appearance of those shown in Fig. 2.

Although nature wills that the parent sacrifice its own body if necessary for the perpetuation of its offspring, the parent cannot give to the offspring more good qualities than the parent itself possesses. Well-proportioned offspring do not come from parents that lack this quality, nor will thick, well-developed thighs come from legs that are long and thin. To raise consistently the best type of market poultry, use must be made of good, vigorous, well-proportioned breeding stock.

12. Eggs from hens that have laid heavily for several months should not be selected for hatching purposes, as they are likely to lack some of the vitality necessary to produce the best grades of market poultry. The best eggs for hatching purposes are those from hens producing a small number. Such eggs are apt to have the greatest vitality and therefore offer a better chance of producing vigorous chicks. As explained elsewhere, it is always advisable to secure eggs for hatching purposes from mature hens rather than from pullets.

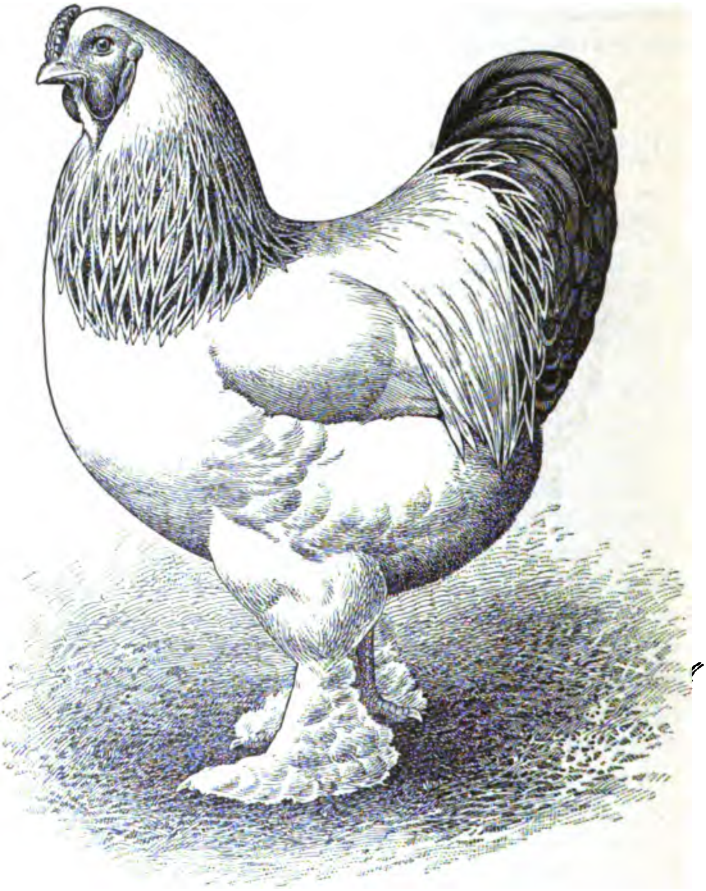


FIG. 3

13. When selecting the breeding stock, due consideration should also be given to the demands of the market in which the poultry is to be sold. The local preferences for size of carcass and color of meat must be adhered to, but under no circumstances is it wise to mix the blood of the white-fleshed breeds with that of the yellow-fleshed breeds.

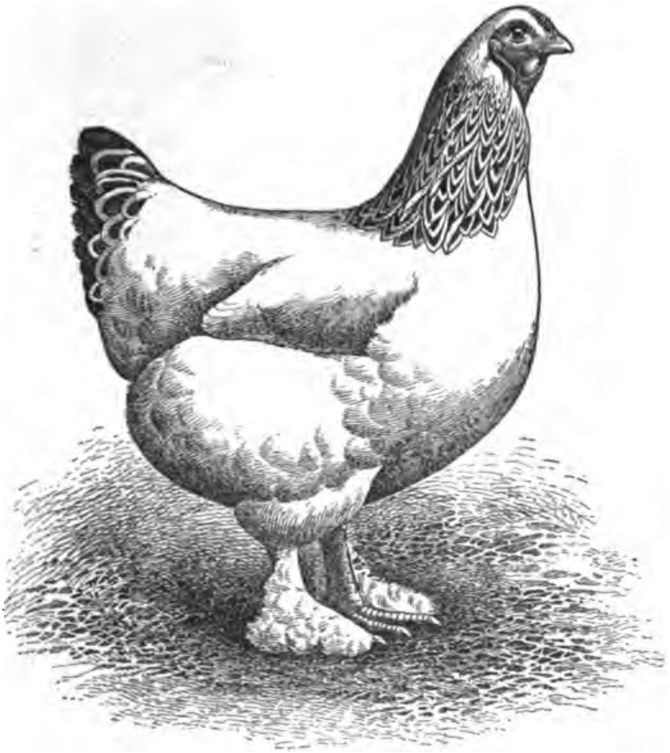


FIG. 4

The color of plumage has no influence on the quality of the dressed poultry beyond the fact that sometimes dark pinfeathers show on the carcass. The color of the plumage is not so closely related to the color of the flesh as is the color of the shanks and beak. Fowls that have yellow shanks also have yellow skin and flesh, as do some of the dark- or black-shanked fowls. As a rule, however, the fowls of the latter class have white or pale skin. No matter which color of skin is preferred in the market, an attempt should be made to produce that color in all its purity.

14. Large, well-proportioned specimens of market poultry cannot be obtained from a mongrel lot of fowls. Great loss is caused annually by the use of eggs from such flocks. The loss is due primarily to lack of vitality in the chicks, and as they grow older the vitality decreases from various causes and makes them less and less desirable for market. Many of the chicks are weak when hatched and in the struggle for food with their stronger companions they fail to get their share. The food that the weaklings do get is also apt to be the least digestible of the lot and causes the death of the poorest specimens. The chicks that do survive are poor in quality and bring low prices when finally sold.

15. Although in some respects the egg-producing type of hen resembles the meat-producing type, there is a marked difference between them, and for the production of the best table meat it is necessary that meat-producing types should largely predominate in the breeding stock. Much loss can be prevented by the selection of meat-producing types for the raising of table poultry. The process of selection should begin when the chicks are young, and, as has been stated elsewhere, the best specimens should be kept for breeding purposes and the others sold as soon as they are ready for the market. While this process of selection is of especial importance in the attempt to build up mongrel flocks, it is also equally important in the raising of pure-bred stock.

16. Heavy-Weight Breeding Stock.—Unfortunately, the value for market poultry, or the utility value, of the heavy-weight breeds of fowls has been affected by long-continued breeding for exhibition purposes. As a result, the shanks, toes, and other parts of the bodies of fowls of the Asiatic breeds are very profusely covered with feathers, which interfere decidedly with the desirability of these breeds for commercial purposes.

Perhaps the most desirable of all Asiatic breeds for producing market poultry are the Light Brahmas. The specimen shown in Fig. 3 shows to a marked degree the characteristics of a good market bird and it does not have the excess of feathers on the shanks and toes that is characteristic of the exhibition type. Brahmas of the type illustrated, mated to hens of a similar character, will produce young from which may be developed the best sort of soft roasters and capons. The type of Brahma best fitted for this work is a heavy-bodied, close-feathered bird with no excess of fluff or feathers on the back, shanks, or toes, with a body long, deep, and well filled in, and with a long breast bone well turned in front. A female Brahma of the proper type is shown in Fig. 4. Brahmas of this type lay brown-shelled eggs of large size.

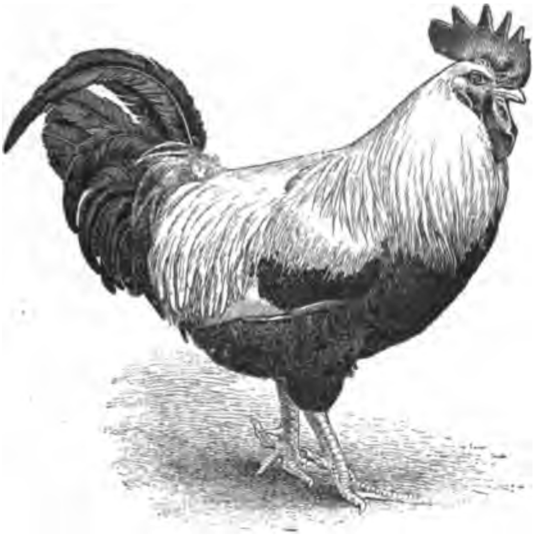


Fig. 5

17. Formerly, the **Cochins** were considered equal to the Brahmas as a source of market poultry, but they are no longer bred especially for that purpose.

18. The **Dorkings** are considered highly desirable for table meat on account of the fine quality of their flesh; in some districts much use is made of them in crossing with other breeds to produce the higher grades of roasting fowls. No fowls excel the Dorkings in length and breadth of breast and in the quality of the flesh. The skin and flesh of birds of this breed are pinkish white in color. As shown in Fig. 5, the Dorking has a body shape that permits the formation of but little waste, the curve under the body from head to tail being continuous without a break. Birds of the type shown in the figure carry a large proportion of breast meat and can be safely selected for the production of table meat. Dorkings thrive best in a moderate climate where the soil is dry. Young Dorkings do not grow as quickly as do the young of smaller breeds.

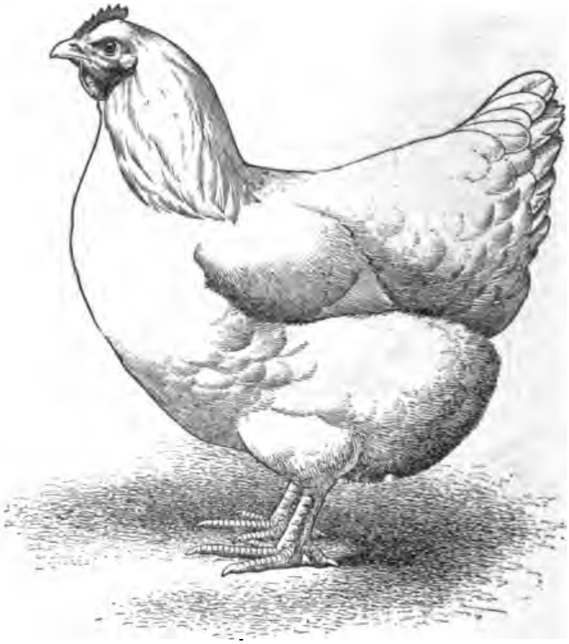


FIG. 6

19. **White Orpingtons** are in reality part Dorkings, as they come from the crossing of Dorkings with other breeds. The White Orpingtons possess to a marked degree the table qualities of the Dorkings, and, like them, show a pinkish-white color in the shanks, skin, and flesh. As with other breeds, the less tendency the White Orpingtons show for profuse feathering the more desirable they will be for market purposes. The hen shown in Fig. 6 is well proportioned in length of body and in length and form of breast and may be accepted as a guide in the choosing of hens for the foundation of a strain of heavy-weight poultry. No matter what breed or variety is chosen, the individuals selected for breeding purposes should have the formation that will produce the meaty fowl that the market demands.

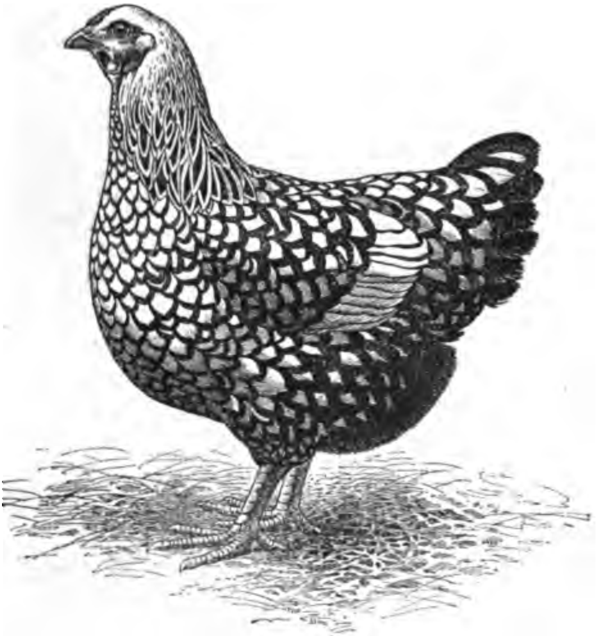


FIG. 7

20. **Medium-Weight Breeding Stock.**—The **Wyandottes** fill an important position as a general-purpose fowl. Not

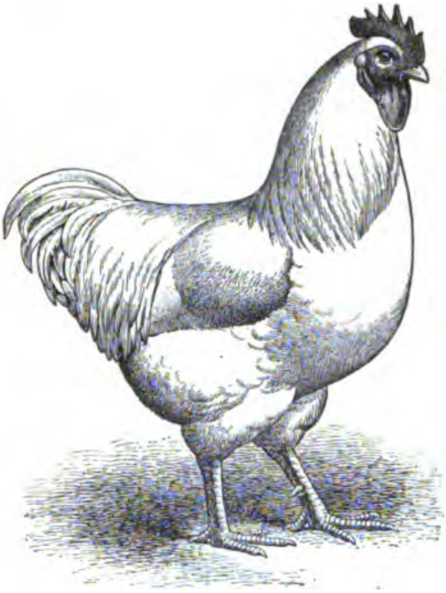


FIG. 8

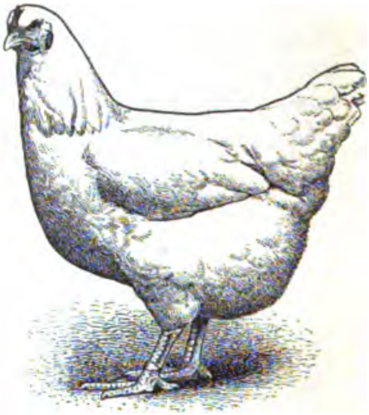


FIG. 9

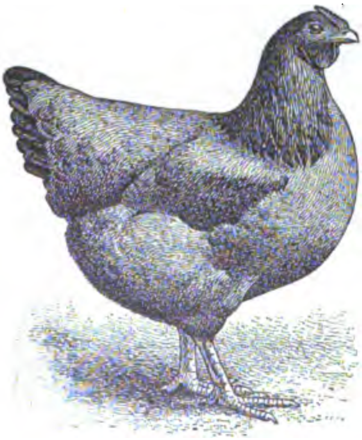


FIG. 10

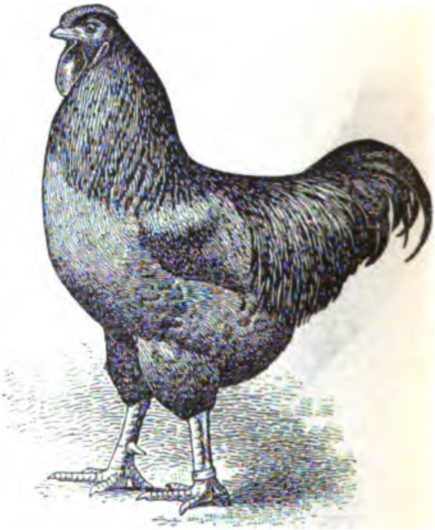


FIG. 11

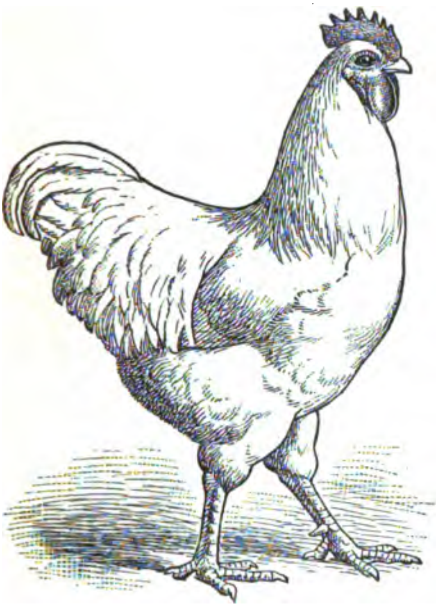


FIG. 12

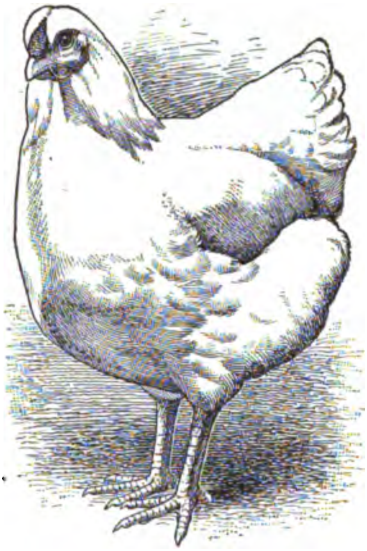
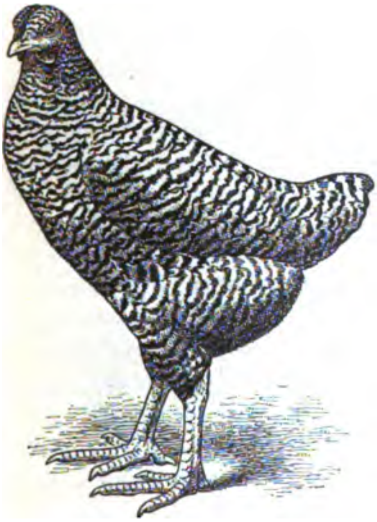


FIG. 13



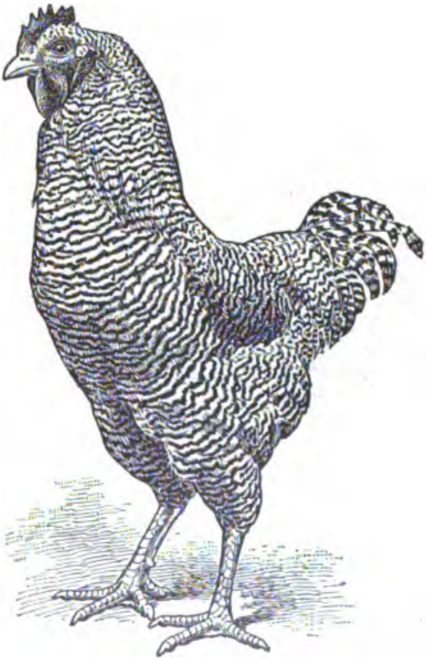


FIG. 14

FIG. 15

only are they prolific egg producers, but they also excel as market poultry. All varieties of Wyandottes that approach the market type excel as broilers and as roasters. The bird shown in Fig. 7 is an excellent type for the production of table meat, but is a little too long in the breast and back and a little too closely feathered to be acceptable for general exhibition purposes. The Wyandottes, like the Brahmas and all American breeds, have yellow shanks, skin, and flesh.

21. Barred Plymouth Rocks have the preference in America over all the other medium-weight breeds, and more Barred Plymouth Rocks are bought and sold in the market than any other kind. This popularity is due to the almost universal distribution of the variety rather than to the excellence of any particular quality.

The body type of the fowls shown in Figs. 8, 9, 10, and 11 can be found in all breeds of market poultry and a shape equally good can be selected from cross-bred fowls. The four birds shown possess to a marked degree the characteristics of desirable market poultry. When selecting the yearling hens and cockerels from which to produce market poultry, it is advisable not to consider the breed of prime importance, but rather to give first consideration to the individual.

22. Undesirable Types of Market Poultry.—Many failures in poultry raising come from misguided efforts, or from attempts to grow something from almost nothing. Fowls that are lacking in form do not produce any considerable number of offspring that are in any way better than themselves. Hens that are faulty in body formation will not produce excellent market poultry even if mated to males of excellent quality. To succeed in any kind of breeding, the breeding stock should be composed of individuals adapted for the purpose intended. In the breeding of market poultry, hens of inferior quality, as well as undesirable males, should not be allowed to mature. The four specimens shown in Figs. 12, 13, 14, and 15 range in quality from that of the white male of poor formation shown in Fig. 12, to the one shown in Fig. 15, which is so destitute of quality as to be of no value for any purpose. The four birds shown are fair samples of the kind of market poultry that is sold at a loss.

23. The white fowl shown in Fig. 13 is lacking in several particulars and would be objectionable if dressed for the market; although not entirely devoid of quality, fowls of this type should not be chosen for use except possibly to produce eggs and light-weight table fowls. The Barred Plymouth Rocks shown in Figs. 14 and 15 illustrate results that are sure to come from skimming out the best individuals from a flock and using only the culls for breeding. It is only necessary to compare this type with that shown in Figs. 8, 9, 10, and 11 to fully realize the folly of trying to raise high-class market poultry from breeding stock composed of culls.

24. Cross-Breeding for Market Poultry.—Cross-mating should be done only by those who understand thoroughly the effects of crossing one breed with another. The results that come from some crosses are sometimes remarkably successful, but although some of the very best market poultry has resulted from crosses, the crossing of two breeds or varieties may usually be considered an experiment. Among the most successful crosses from which to produce market poultry are the Light Brahma males with Dorking females, and Dorking males with Wyandotte, Plymouth Rock, or Brahma females. White Leghorn males with Plymouth Rock or Wyandotte females produce good squab broilers. In cross-mating, all specimens should be true to breed and of good quality. As there are breeds adapted for every purpose, it will usually prove more satisfactory to select one breed and breed it in its purity rather than to experiment with cross-breeding.

25. Care of Breeding Stock.—The management and care of breeding stock for market poultry should be about the same as that for laying hens, except that little if any wet mash feed and no forcing feed should be given. The feed for market-breeding stock should consist of dry grain, dry mash, animal food, grit, and green food. Not so many eggs will result from this kind of food, but those laid will be more apt to be fertile, especially if the hens are compelled to dig and hunt in the litter for their food, and a large percentage of their eggs will produce good, vigorous chicks.

26. In general, the ration of the breeding stock may be any good egg-producing ration that contains no injurious or stimulating foods, or foods that have a tendency to soften the organs of digestion or reproduction. The use of foods that have a tendency to loosen the bowels and an excess of fat-forming foods should be avoided. Hopper feeding may be practiced in the dispensing of dry mash, meat scrap, and grit, but all whole grain should be fed in dry litter so deep that the fowls must make some effort to obtain the food. The foregoing method of feeding may be practiced throughout the year in the care of yarded fowls; but in the care of fowls at liberty, the grain may be scattered on the ground during the warm season of the year.

27. Breeding stock should have as much liberty as possible. This statement does not mean that they should live in the open as much as possible, but that the space alloted to them should be as large as circumstances will permit. Regular daily exercise has an important beneficial effect on the strength and vitality of the chicks to be produced. Any one of the houses fitted for laying hens may be used for the breeding stock of market poultry, care being taken, of course, to select one adapted for the location where it is to be used. The same kind of care should be given the house and its equipment as is given in the care of houses for laying hens.

GENERAL MANAGEMENT OF MARKET POULTRY

28. The raising of market poultry may be made an exclusive business, but there is a greater chance for success if it is made a branch of a general poultry business. In an establishment for the production of both eggs and market poultry, the surplus stock is sold for table meat and the best egg producers are retained. In an establishment of this kind, the

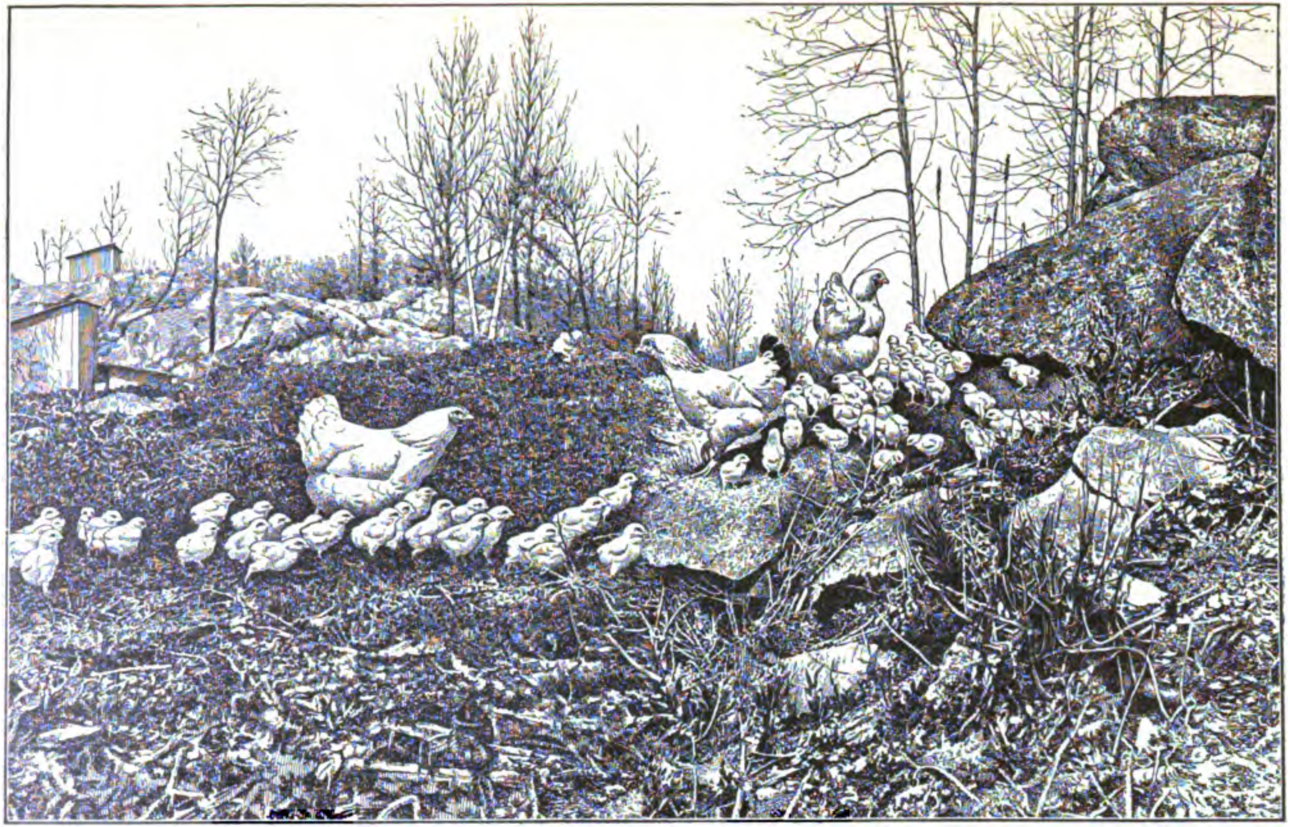


Fig. 16

undesirable hens and old cock birds can be disposed of after July, their places being filled by the pullets and cockerels, and all stock not wanted for egg production can be marketed before winter begins. Little waste is experienced in the operation of a general poultry farm, because each flock may be culled as its members mature. As the season advances, all cull pullets, and all cockerels except those reserved for breeding, are sold, thus lessening the cost of keeping the flock. In the raising of all kinds of poultry, care should be taken not to incur loss by scanty feeding.

29. Whether market poultry is hatched and brooded artificially or naturally is largely a matter of preference. The matter of the greatest importance is that the raising of the chicks be well done. Any of the many types of coops, pens, and yards described elsewhere can be used in raising market poultry, the only essential in the selection being that the device chosen shall be adapted to the locality and to the number of chicks to be reared. Where the growing of market poultry becomes a business, there must be a more complete organization than is needed where only small numbers are grown. Convenience in arrangement of buildings and yards is of great aid in lessening the expense of caring for the incubator rooms, brooder houses, and other buildings needed on a poultry farm.

30. In some cases, good success in raising large numbers of market poultry has been achieved by the use of hens for hatching and brooding. Land that is not suited for other purposes may sometimes be used as a range for hens and chicks. Fig. 16 shows a farm on which more than 5,000 chicks have been raised in a single year. During the day, the hens wander with their broods, and both hens and chicks stay at night in small colony houses. Chicks brought up in this environment must acquire vitality from the very air and become rugged as a result of constant exercise. When such chicks reach broiler size, they have a constitution that does not break down under forced feeding. They are also well fitted for development into egg producers or breeding stock.

31. Brooder House for Market Poultry.—The brooder house shown in Fig. 17 is well suited for use in a warm climate or in a temperate climate in hot weather. In this house, small indoor brooders are used, and when the weather permits the chicks run outdoors. Where there is no natural shade, shelters of canvas or cotton cloth are drawn over the top of the fences, as shown in the illustration, thus shading the brooder house and part of the run. If the shelters are well separated, the chicks will be encouraged to take exercise. Still more exercise can be encouraged by feeding one meal under the shelter near the house and the next meal at the other end of the run. The chicks may be kept in this style of house until they are completely feathered.

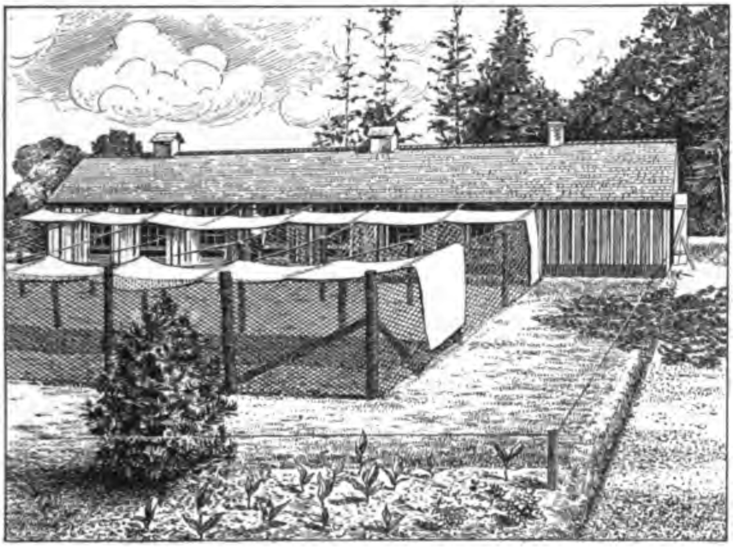


FIG. 17

32. Colony House for Market Poultry.—When the chickens are fully feathered, they should be separated into flocks of not more than 100 each, which should then be put into colony houses. These houses may be located in any convenient place, preferably near shade and good range. The houses shown in Fig. 18 are located in open range and on rough land that can be used for little else than poultry keeping. When first put into the colony house, the chicks should not be allowed to range freely but should be confined to the open run *a* until they have become accustomed to their new home. After several days, the door of the house may be opened for a short time before dark, care being taken to see that all the chicks return to the house before night comes on. After the chicks have been taught to know the house allotted to them, they will go into it every night. To get the chicks better accustomed to their home, the morning meal of each colony should be given to it within the house. In fact, all of the meals should be given in the house or near it.

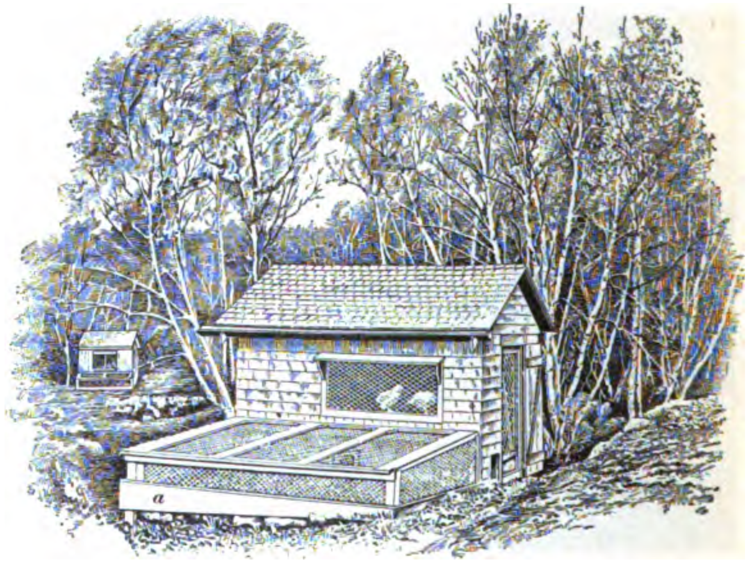


Fig. 18

The house shown in Fig. 18 is made either 8 feet by 10 feet or 8 feet by 12 feet and is thus large enough to mature about 50 soft roasters. It should be so constructed that rats and other vermin are excluded, and the windows and the inner doors should be covered with wire netting. During hot

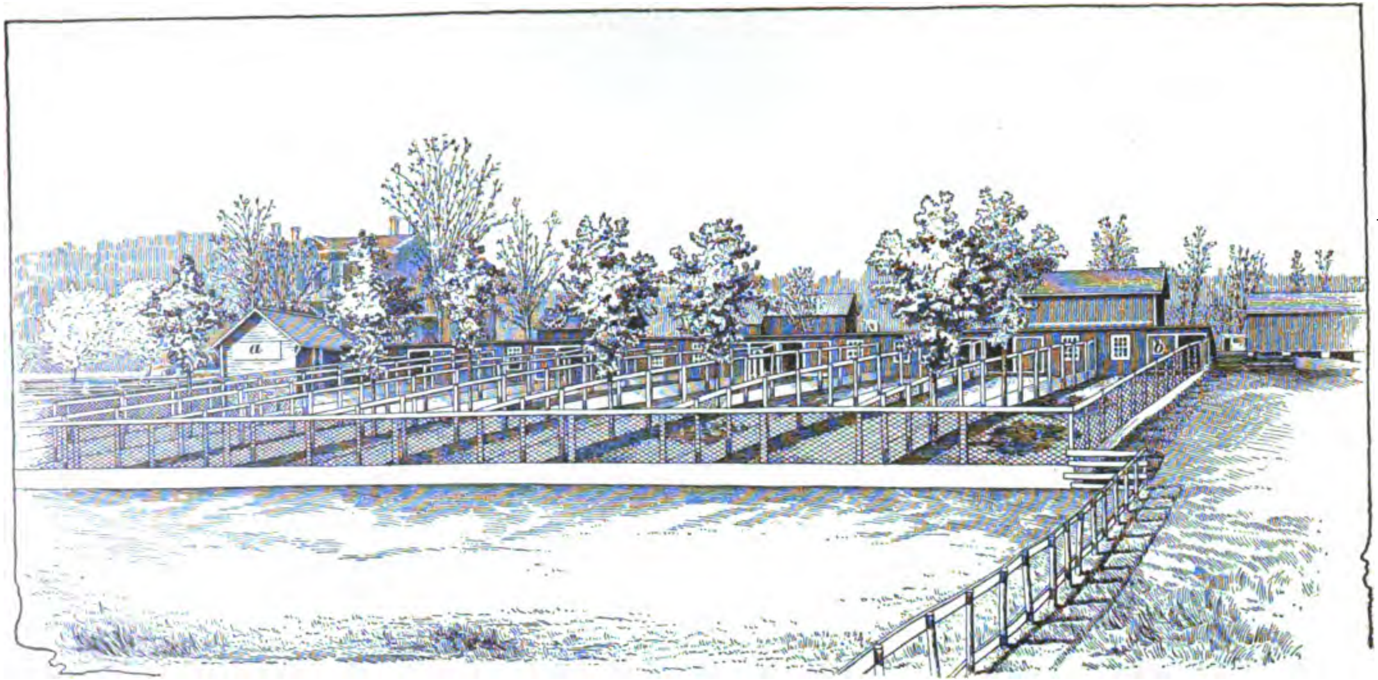


Fig. 19

nights, neither the outer door nor the windows are closed, and the windows should never be closed except with muslin curtains.

33. Connected Pens for Raising Market Poultry.—Where free range is not available, the chicks, after the brooding period, may be grown in houses with connected pens. Connected pens are especially desirable in districts where there is no natural shade, and chicks that are intended for market poultry are sometimes grown to advantage when kept constantly confined. A connected-pen plant is shown in Fig. 19. Each pen in the house *b* is provided with a roosting room and a scratching shed. The entire length of the building, which extends from both right and left of the feed-house *a*, is 336 feet. The yards shown are 16 feet by 50 feet and should be provided with shade trees set so as not to interfere with the cultivation of the soil. After the harvest of the crops in the field surrounding the yard, the chicks may be given the run of the entire place. When the time comes for fattening the chickens, a temporary fence may be placed across the yards close to the houses in order to prevent the birds from exercising during the fattening period.

34. Hatching and Brooding Market Poultry.—Chicks for the production of table meat may be hatched either by natural or by artificial means, the method selected depending somewhat on the number of fowls to be raised. For hatching and brooding large numbers at any time or for a comparatively few in winter, the use of artificial methods will usually prove advisable. If more than 50 chicks are to be raised, the care and expense of growing them are usually less with artificial methods than with natural. The hatching and brooding of market poultry should be done in accordance with the principles explained elsewhere, except when special methods are necessary in the production of special kinds of market poultry.

35. It should also be borne in mind that the stock used for breeding each year must be managed with special regard for the vitality of the offspring. For this reason, all breeding

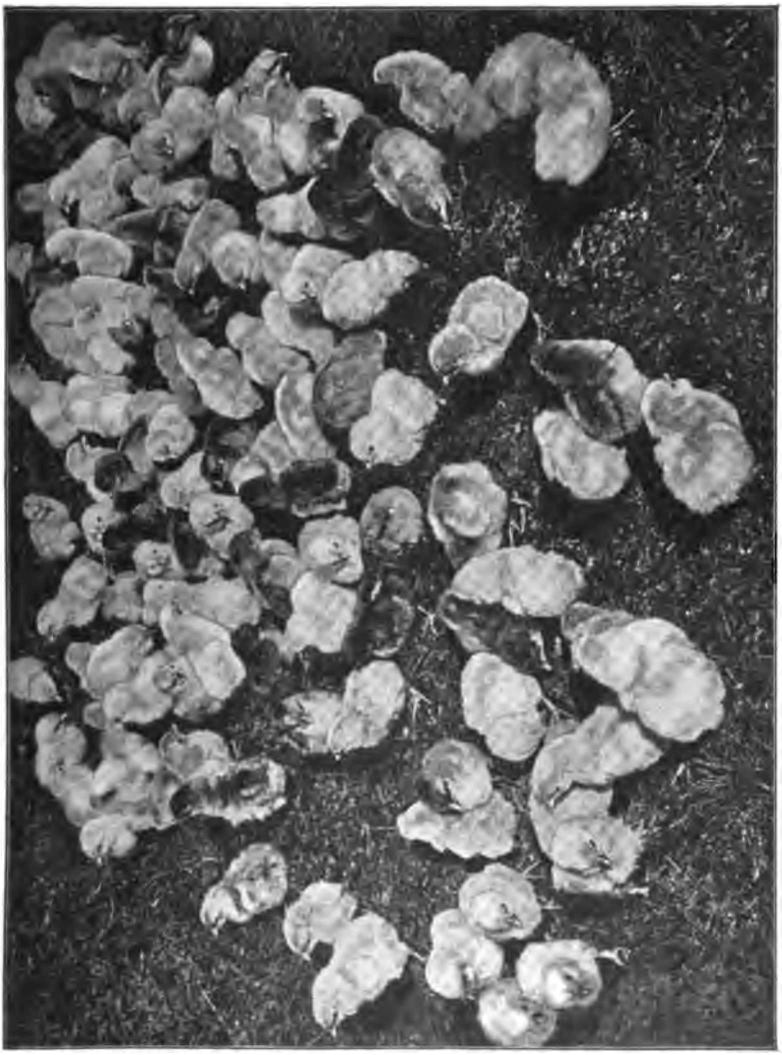


FIG. 20

stock should be raised in the open and hatched and brooded as far as possible by hens rather than by artificial means. When these points are neglected or disregarded, the eggs will be found less fertile and the chicks from them will lack vitality and consequently there will be a high death rate. The chicks shown in Fig. 20 have marked evidence of vigor and strength. These chicks came from stock that was managed for years with the express design of producing the very best market poultry. The chicks have not only vitality, but good size and form as well. But few if any difficulties should be experienced in the raising of such chicks as these. They should grow rapidly and develop quickly into plump broilers or well-finished roasters. Chicks like those shown in Fig. 20 are not likely to lose their appetites nor to contract ailments or diseases.

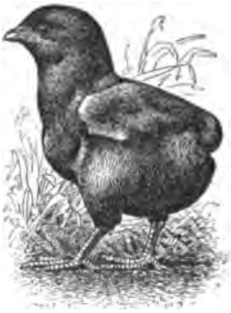


FIG. 21

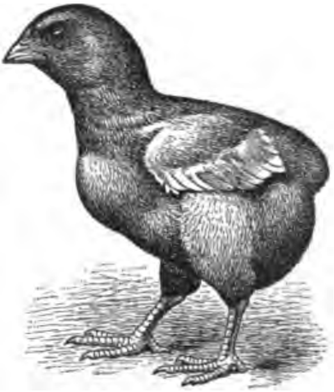


FIG. 22

36. The **development of chicks** should be uniform. Each one should closely resemble all others, and each part of the body should be in the same stage of growth. In Fig. 21 is shown the appearance of a well-grown chick at the age of 2 weeks. The entire body formation is strong and bulky and the shanks are short in proportion to the rest of the body. This kind of development should continue from day to day. The chick at 3 weeks of age should have the appearance shown in Fig. 22. When the chick continues to grow as it should, it gathers strength, and its crop and abdomen become more prominent, giving evidence of strength and vigor in the digestive organs.

After feathers begin to appear, the body itself does not grow so fast as before. Since considerable food is required to produce feathers, more nutritious food should be given at the time of feathering out so that the growth of the plumage will not unduly retard that of the body. Chicks of the Mediterranean breeds and other chicks that have a tendency to feather rapidly while young do not grow as rapidly before the age of 4 weeks as later. Body growth in these cases is retarded because the digestive system cannot assimilate food enough to produce new growths of both feathers and flesh. The growth of young chicks may be hastened by the use of wet mash, but chicks that are forced in this way while young do not grow so fast after they are 8 weeks old. As soon as the chick is completely covered with feathers, the rapid body growth begins again. Although it is possible to produce squab broilers in 8 weeks, it requires rapid growth to have them fit even at the age of 10 or 12 weeks.

37. Feeding of Market Poultry.—Up to the time of weaning, all kinds of market poultry are fed in the same way. The main requisite is to keep them constantly growing without overfeeding them or allowing them to get "off their feed" from this or any other cause. When this occurs, they should not be fed until the appetite returns. When the chicks are fed every few hours, the omission of one meal may bring back a normal appetite, but where hopper feeding is practiced the hopper should be removed and no food should be given for several hours.

The greater part of all market poultry used for small-sized roasters is selected from the great mass of farm-grown poultry. To produce the best roasters, the chicks should be so fed that they will be plump and have a weight of about 4 pounds when dressed. To secure these results requires that the birds be well supplied with a high-grade growing ration.

Market poultry should be part hopper fed and part hand fed. The hopper feeding should consist of dry mash, meat scrap, and grit. Wet mash and small grains should be fed by hand. The greater the variety of food given, the more the fowls will consume and the fatter they will grow, provided, of course, that the entire ration is growth producing and does not tend to the excessive production of internal fat.

Leghorns for market can be grown profitably to broiler size only. The American breeds (Plymouth Rocks, Wyandottes, and Rhode Island Reds, and the English breeds (Dorkings, and Orpingtons) are well suited for all kinds of table poultry. The birds of these breeds that are plump when small can be sold for broilers; those that fail in this respect should be grown to roaster size. Not all kinds are plump at 8 to 12 weeks, and some individual specimens of all kinds will not be plump at broiler size, yet they may be grown into excellent roasters.

38. Those who raise market poultry should aim to secure the best results from the grain fed. Poultry that loses 40 per cent. of its entire weight on being dressed is not desirable, nor will such poultry bring a price sufficient to pay for the grain used in its development. The carcass of a young fowl that weighs 3½ pounds when taken from the range is made up of about 2 pounds, or about 57 per cent., of bone and waste and 1½ pounds of edible meat. Such a fowl will rarely be sold at a profit. If, however, it is shut up for a period of 18 or 20 days, it will consume not more than 8 pounds of food and should gain 2 pounds in weight. The cost of the 8 pounds of feed should not exceed 16 cents. As a result of the fattening, the waste in dressing will be about 36 per cent. instead of about 57 per cent., and the meat will be improved in quality. Before being fattened, the fowl might have been sold for 12 cents per pound, or a tótal of 42 cents, which is at the rate of 28 cents per pound for the 1½ pounds of edible meat; after being fattened the fowl will sell for at least 14 cents per pound, or a total of 77 cents, which is at the rate of 22 cents per pound for the 3½ pounds of edible meat. The fattening is thus profitable to both producer and consumer, since, on the basis of a cost of 16 cents for fattening, the producer would gain 19 cents, and the consumer would save 6 cents on each pound of edible meat, or 21 cents on 3½ pounds. It should be remembered that the figures given are purely arbitrary and that the prices are not applicable to all regions; but, no matter what the price may be, the true value of the carcass should be determined not by the total weight of the fowl but by the percentage of edible meat on the carcass.

PRODUCTION OF BROILERS AND ROASTERS

39. Classes of Broilers.—The growing of broilers exclusively is the most precarious branch of the market-poultry business and should not be undertaken until experience has been gained, either through direct connection with a large broiler plant or exclusive control of a small one. Broilers are divided into three classes: (1) *squab broilers;* (2) *spring broilers;* and (3) *fryers, large broilers,* or *small roasters.* **Squab broilers,** the smallest of the three classes, range in size from ¾ of a pound to 1 pound each in weight. They are used by the hotel and restaurant trade during the winter and early spring. They must grow quickly and be plump and uniform in size. As the season advances, the market calls for **spring broilers,** or broilers that range in weight when plump from 1 pound to 1½ pounds. The weight demanded increases as the season advances, until the 2-pound size is the most popular. **Fryers, large broilers,** or **small roasters** range in weight from 2 to 3 pounds and may be used as preferred, either as large broilers or as small roasters. Although, in general, the greatest success in the market-poultry business is achieved by those who grow all sizes, success in many cases has been obtained by the exclusive production of one size of market poultry.

40. Broiler Plants.—Plants run exclusively for the production of broilers very seldom produce their own eggs for

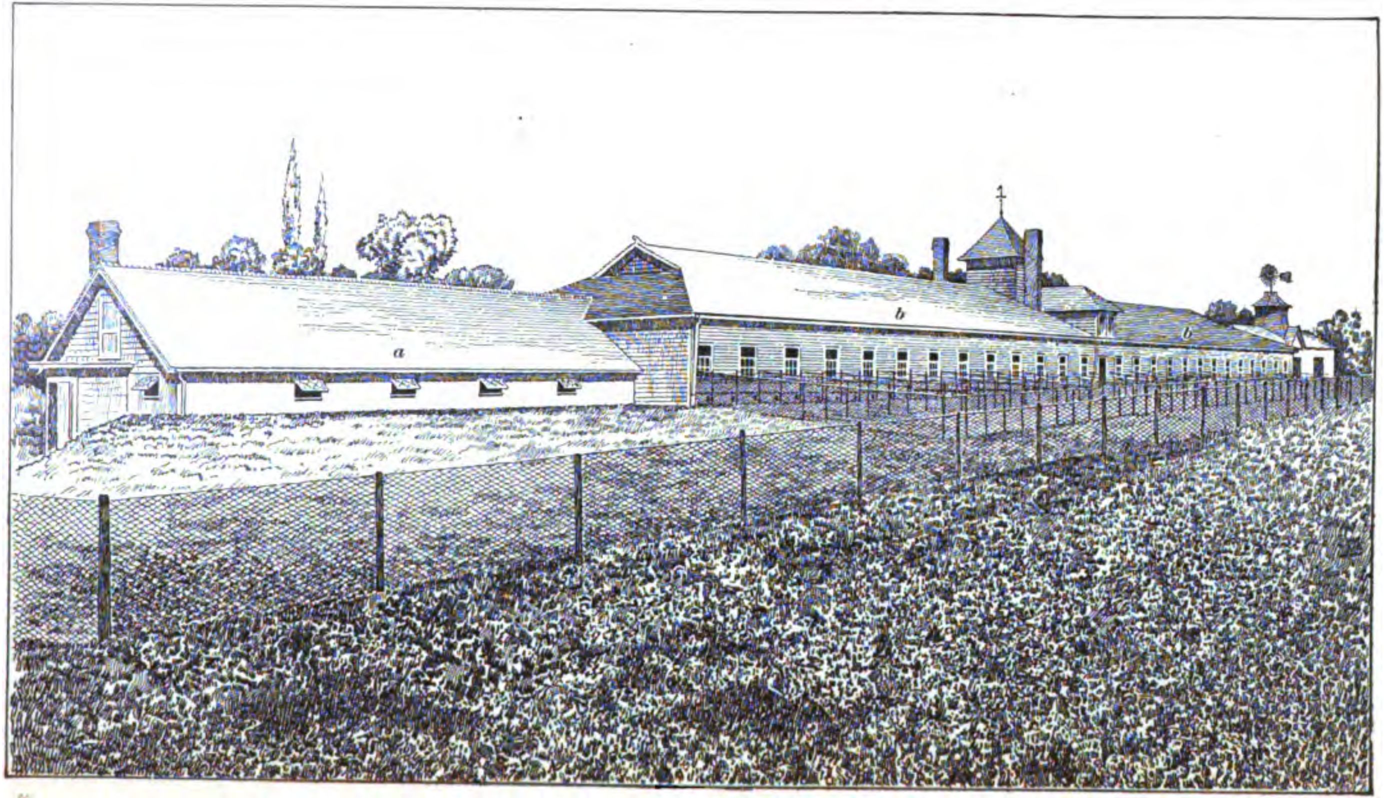


FIG. 23

hatching. Some proprietors, however, keep hens and produce only enough eggs to keep their incubators running. The owners usually think they have enough to do in caring for the chicks without being bothered with the work of caring for the hens.

In Fig. 23 is shown a building that is well suited for use on a farm where broilers are raised exclusively. The wing *a* contains the incubator cellar, which is built partly below the surface. The chicks when hatched are taken to the brooding rooms without leaving the building. There are two brooding rooms *b* of equal size, one on each side of the towers, beneath which is the heating apparatus for the entire plant. The Thomson system of heating, described in *Poultry Farms*, can be used in the operation of this as well as other broiler plants. At the extreme end of the building, beneath the windmill, is the building in which the killing and packing are done. The interior of this building can be equipped in accordance with any of the plans shown for other buildings.

The ice house should be located a short distance from the killing house and should be of sufficient capacity to supply the ice necessary for packing and shipping purposes. The broiler plant should also be provided with a cooling room so built that ice used in it can be supplied directly from the ice house.

41. Feeding of Broiler Chicks.—Although chicks intended for broilers should have the same treatment as all brooder chicks and should have all the food they need from the beginning to the end of their existence, the process of fattening should not begin until after they are 4 weeks old. After this age, they should be forced by means of wet mash and meat scrap. The fattening process should be carefully managed or the chicks will break down and become unable to move about. When this occurs, the affected chicks, if large enough for sale, should be killed and dressed immediately. If they are not large enough for sale, they must be removed to a separate apartment of the brooder reserved as a hospital. Forced feeding at the age of 4 weeks is done at a risk, even by those experienced in the work. The successful fattening of broilers, even by experienced feeders, is difficult. The difficulty is due to the fact that at broiler age most of the food consumed is utilized mainly to produce bone, muscles, and feathers. When an excess of fat-forming material is given, the health of the bird is likely to be injured. If mash is given, 10 per cent. of it should consist of meat scrap. It is well for the beginner not to try to produce excessively fat broilers, but to content himself with well-grown specimens in fair condition. The experienced grower usually develops and follows his own methods.

It will generally prove advisable to raise several sizes of broilers. The squab broilers may be selected from the young cockerels as they develop, and the larger sizes of broilers from the larger cockerels and pullets as they develop plumpness and fair size. After the end of May, naturally grown broilers begin to come into the market from the warm districts, and from then until winter the markets are well supplied with all kinds of farm-grown market poultry.

TABLE IV
TIME REQUIRED TO RAISE BROILERS AND ROASTERS

Breeds of Fowls	Growth, in Pounds, in 8 Weeks	Growth, in Pounds, in 10 Weeks	Growth, in Pounds, in 12 Weeks	Growth, in Pounds, in 21 Weeks	Growth, in Pounds, in 26 Weeks	Growth, in Pounds, in 30 Weeks
Leghorns		1	1¼			
American breeds	1	1½	2	4	6	7
English and Belgian breeds	1	1½	2	4	6	7
Brahmas	1¼	2	2¼	5	7	9

42. Time Required to Produce Broilers and Roasters. The time required for a chick to grow to a marketable size depends largely on the quality of the chick and its breed. Not all breeds mature alike; some grow to broiler size and are fit for selling in a shorter time than other kinds; some are best for small broilers and are unfit for roasters; and other kinds are better suited for roasters than broilers. The average development of several kinds of fowl are shown in Table IV. This cannot be absolute, because some of each kind may be better suited to the purpose in one locality than in another; then again, much depends upon the stock from which they come. When bred and fed as they ought to be, the average is about as indicated in the table.

43. Broilers 10 weeks old are shown in Fig. 24. Broilers of the size and quality shown result only from proper breeding, care, and feeding, and for such the highest prices are paid. A 3-months-old broiler is shown in Fig. 25; in this specimen, the distance between the thighs and the length and breadth of the breast tell of inherited vitality and strength.

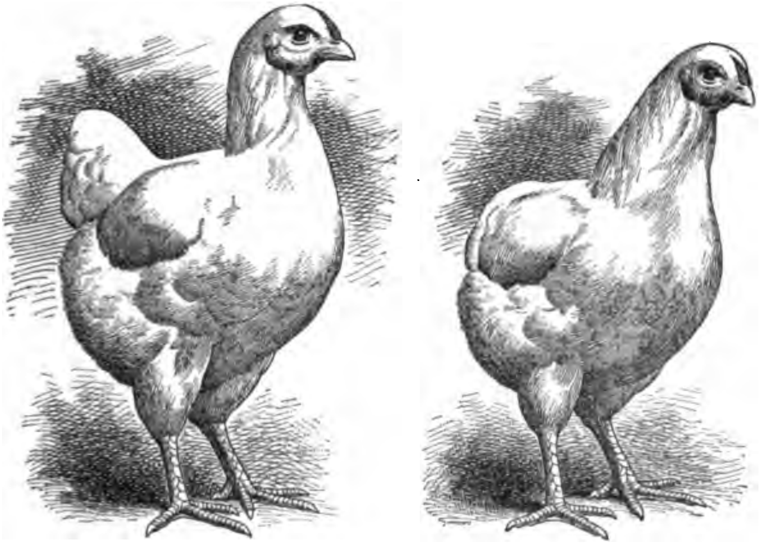


FIG. 24

Note the contrast between this bird and the poor specimen shown in Fig. 26. The latter bird is the son of the male bird shown in Fig. 15, and is a fair specimen of a bird produced from stock useless for the production of either eggs or market poultry. The neck, shanks, and thighs, the least desirable parts of a bird, are prominent in the bird shown in Fig. 26

and form a large proportion of the entire weight. A deficiency in breast and abdomen greatly lowers the market value of the bird, which is also likely to be deficient in vitality. Although the birds shown in Figs. 25 and 26 received the same care and attention and were raised in the same environment, one was a finished broiler at the age of 3 months and the other was a poor specimen at the age of 4 months and never developed into a bird fit for any useful purpose.

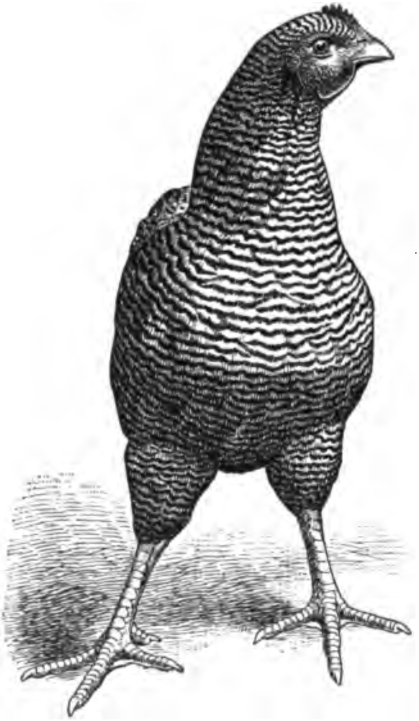


FIG. 25

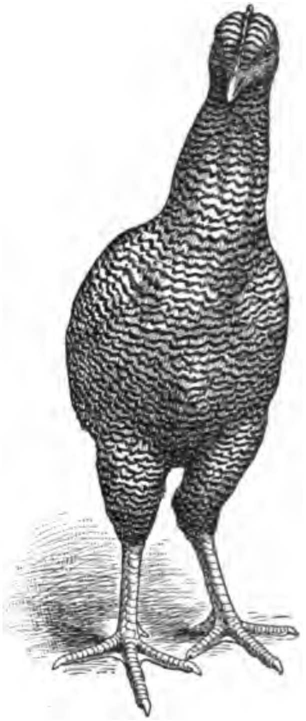


FIG. 26

44. Roasters.—There are two kinds of **roasters,** plump, meaty roasters, and soft roasters. The real value of a roaster depends on the cuts that can be taken from the carcass when cooked. Hotels and restaurants require **plump, meaty roasters** that can be served either hot or cold or used for sandwiches, croquettes, or hash. In many cases, old hens or turkeys are used for these purposes simply because suitable young chickens cannot be obtained. A 5- or a 6-pound fowl of uncertain or old age, however, simply because it has the size and appearance of a roaster, is not fitted for such use.

The term **soft roaster** should be applied only to the plump and tender carcass of a young fowl. No matter how pleasing the carcass may be in appearance, it should not be graded as first-class market poultry unless its flesh is soft and tender.

45. Roasters may be produced at a profit in nearly every locality where they can be sold alive for not less than 20 cents a pound. In the raising of roasters, the poultryman must produce the best or be content with the average market price for a medium product. The raising of soft roasters may be an exclusive business or it may be a part of the general poultry business. In some locations, it has become the exclusive occupation of a neighborhood. A soft roaster may be a quickly grown cockerel, pullet, capon, or poulard. Chicks from which soft roasters are raised are usually hatched in the fall and the soft roasters are marketed between the middle of January and the first of June.

It is difficult to obtain eggs at all in the fall and it is doubly difficult to get hatchable eggs from the kind of fowls best suited for soft roasters. To supply the eggs for soft roasters, pullets are hatched during the winter. The eggs of Light Brahmas and both White and Barred Plymouth Rocks, either thoroughbreds or crossed, are used for hatching soft roasters.

46. The hatching and brooding of chicks for the production of soft roasters is generally done artificially. The chicks are kept in brooder houses until they are large enough to go into the colony houses. In soft-roaster plants, hatching is begun in August or September and is completed by the end of January. The eggs used generally come from fowls specially selected and managed for the purpose of securing eggs from which large-sized, slow-maturing birds may be grown. If, however, the roasters are to be sold at the weight of 4 pounds, quick-maturing stock should be used. Heavy-

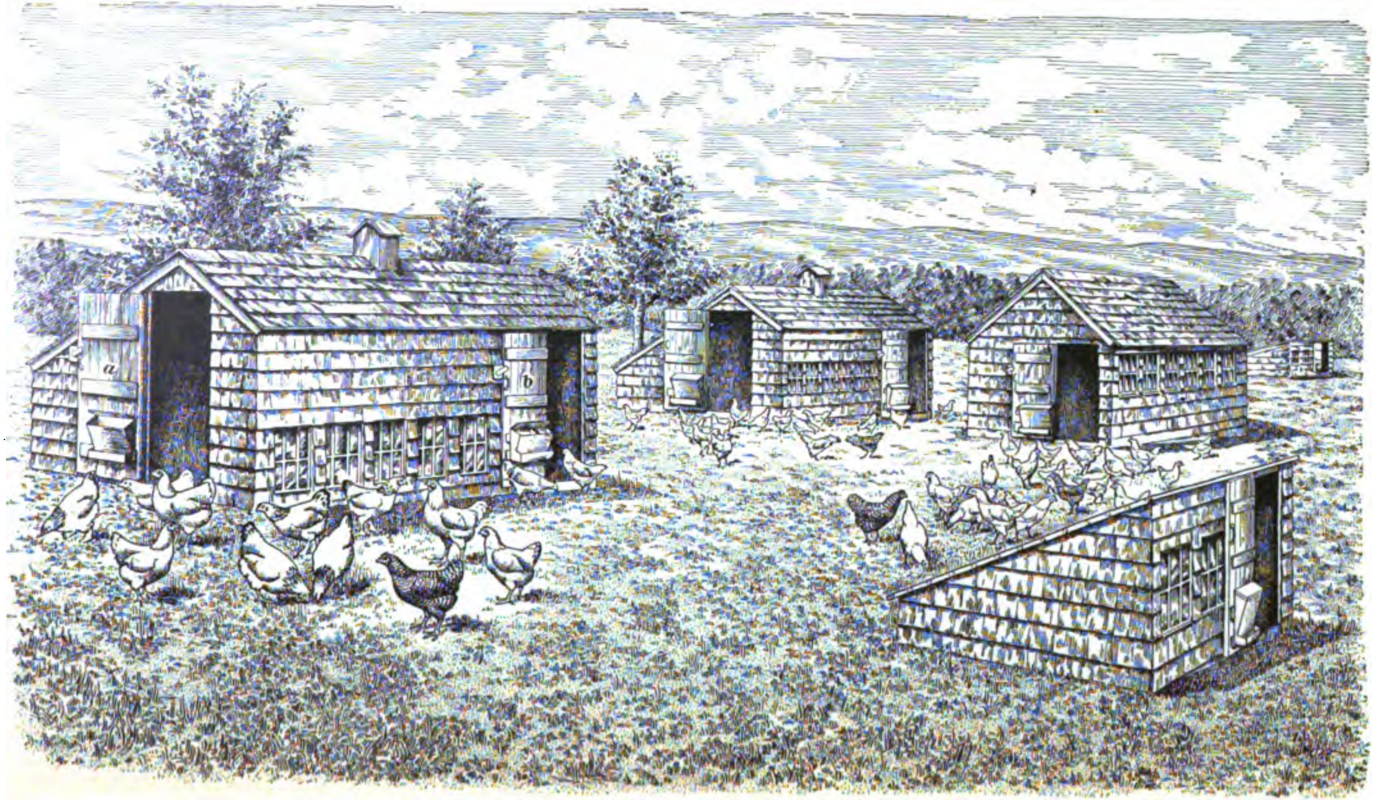


FIG. 27

weight and light-weight roasters cannot be successfully produced from the same stock.

After the brooder age is passed, the chicks can be moved to colony houses of the type shown in Fig. 27. Each of the houses is large enough to mature 50 chicks and there is room for 50 of these houses and flocks on 8 acres of land. The weather is usually cool when the half-grown chicks are placed in these houses, but the door should be opened each day and the chicks permitted to go about at will, except, of course, in the case of heavy snow or extremely cold weather. Soft roasters must not be permitted to roost on perches; they should pass the night on the floor of the house, which should consist of dry earth covered with sand. The sand should be frequently changed, to keep it in a sanitary condition, and be covered with dry straw. Where the ground is damp, board floors can be laid in the houses. Each colony is fed inside the house or near the door. When plentifully fed, the chicks will wander but little. The cockerels should be caponized as soon as they are old enough for the operation. Directions for caponizing are given elsewhere. The specimens first sold are pullets that are inclined to lay, and *slips*, or imperfectly caponized cockerels; the flesh of laying pullets becomes hard and the slips disturb the other members of the flock. The pullets suitable for use as soft roasters should weigh about 5 pounds at the beginning of the selling period, and about 7 pounds at maturity. The males should weigh at maturity from 8 to 9 pounds or a little more. Soft roasters are sold at ages ranging from 7 to 9 months.

The main difficulty in growing soft roasters lies in the fact that the season of high prices lasts only about 60 days and that there are 7 months of constant expense. Of course, it is possible to continue hatching later than the first of January, but this is seldom if ever done in soft-roaster plants. The early spring chickens resulting from late hatching may be used as broilers or as summer roasters. Summer roasters should be sold as soon as they have gained suitable size, for as soon as they become long in leg they lose much of their value.

47. Feeding of Soft Roasters.—Up to the time of weaning, soft roasters are fed the same feed as other chicks. After weaning, they should have whole or cracked grains and both wet and dry mash. Meat scrap is usually kept before them after the age of 3 months, and they are gradually taught to help themselves from hoppers containing corn, meat scrap, and dry mash. Wet mash is given to them once or twice a day. A dry-feeding system is given the preference, as there is less trouble from a dry-mash than from a wet-mash system. In a dry-mash system of feeding, the fowls grow as rapidly as in a wet-mash system and their droppings are dry, thus making it easy to keep the floor in good condition.

The plant shown in Fig. 27 is located on land that has a gentle slope toward the south—just enough for drainage. The chickens are fed by means of hoppers as well as by hand. The hopper that hangs on the inside of the door *a* is filled with cracked corn. Another two-part hopper is hung on the front door *b*; one part is filled with meat scrap and the other with grit. The fowls can help themselves from these hoppers at will. A mixture of wheat, barley, oats, and other grains—the greater portion of the mixture being wheat—is fed to them in flat box troughs. Occasionally, wet mash is fed. The main requirement is that the fowls shall never go hungry—they can eat from the hoppers even though they are inside the house and the doors are closed.

MARKET POULTRY

(PART 2)

PRODUCTION OF MARKET POULTRY

(Continued)

PRODUCTION OF CAPONS AND POULARDS

1. A **capon** is a castrated cockerel, and the operation of castrating cockerels, which is done to improve the fowl for market purposes, is known as **caponizing.** A capon's comb, wattles, and spurs, unlike those of a cockerel, never develop; a capon seldom crows or molts; but, on the other hand, the plumage of a well-fed capon is as brilliant as that of a cockerel. The head of a capon has a distinctive appearance of its own, being unlike that of either a cock or a hen.

2. A **poulard** is a pullet with the power of egg production removed, and the operation accomplishing this is known as **poulardizing.** Hence, poulards bear the same relation to pullets that capons bear to cockerels. The operation of poulardizing is not often performed. Superfluous cockerels can be profitably caponized because they are useful only for the production of meat, but pullets are useful for egg production, and under ordinary conditions poulardizing would result in an actual financial loss. Because of these facts, only caponizing will be fully explained. After the operation of caponizing has been mastered it is a simple matter for any one to become just as proficient in poulardizing if desired.

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3. Contrary to a somewhat prevalent belief, the operation of caponizing is not particularly painful. The cockerels show little signs of suffering when the incision is made between the ribs, and only occasionally wince when a testicle is twisted off. The fatality from caponizing is quite low, the loss often not exceeding 2 per cent. when the operation is skilfully performed, and frequently proficient operators do not cause a fatal accident during an entire season. As a rule, the only birds that die under a well-performed operation are those that have developed combs. As a matter of fact, the pangs of hunger the fowls experience from the fast previous to the operation seem to be much greater than any pain they suffer on the operating table. A fowl in the midst of the operation will frequently reach out its head to peck at some crumbs of food that may be lying on the table, or at a fly that may light near it; after the operation is over the fowls never seem to worry about the cuts in their sides, their entire attention being usually centered on the soft food and water that is immediately given to them.

4. Advantages of Caponizing.—The two important advantages secured by caponizing are the production of a greater quantity and a better quality of edible meat on the carcass of a fowl. An incidental advantage is that capons can be handled more easily and can thus be produced at a lower cost for the same weight than is possible with uncaponized cockerels.

5. Capons will gain more flesh than cockerels from an equal amount of food because the energy that would otherwise go into fighting and supporting the activities of the reproductive organs is utilized in developing desirable flesh on the bird. Cockerels, as every poultryman knows, fight almost continually among themselves and abuse the pullets if the two sexes are not separated. Capons attain their marketable size more slowly but grow fully one-third heavier in weight than cockerels of the same type and variety at the same age, and the additional weight is almost entirely edible meat.

6. The flesh of an 8- or a 9-months-old capon weighing 9 or 10 pounds is as tender and juicy as that of a spring chicken; in fact, capons owe their higher selling price per pound and much of their popularity to the quality of their meat. The white meat of a capon is very pure and clear, and the dark meat is very much lighter in shade than the dark meat of either a cockerel or a pullet. When roasters are worth 16 cents per pound, capons frequently bring twice that price. Finished, well-fattened capons make a fine appearance on account of their plump, broad breasts, so well filled out that the entire breast bone is hidden with the usual exception of the tip of the point in front, which is seldom covered.

7. Capons owe their relative low cost of production as compared with cockerels to their peaceable, contented, and generally docile dispositions. They can be left to run indiscriminately with males or females during the growing period or they can be kept in flocks of 500 or more by themselves, if necessary, without showing the least disposition to quarrel, and they can be kept even more closely confined than hens or pullets. They love to cluster together in groups to sun themselves and to doze until feeding time comes again.

8. When chicks are raised by natural brooding, mature capons may be utilized to relieve the hen of this work and allow her to get back almost immediately to the production of eggs. With a little training, the capon makes a very satisfactory substitute for the mother and, on account of its large size, can take care of from 25 to 30 chicks, or about twice as many as can be cared for by one hen. It is also claimed that a capon will take better care of chicks and will scratch for them and protect them better than a hen after it once becomes accustomed to them. A capon is ready to take up maternal duties when it is about 9 or 10 months old.

The method of training a capon to brood chicks is as follows: Pluck a few feathers from its breast, and strike it sharply on the bared spot with a small switch so as to cause smarting and itching. Then place the capon in a dark box about 2 feet square with some partly grown chicks. In all probability the capon will at once take kindly to these chicks, willingly allowing them to huddle under its breast so as to relieve the smarting and to warm it. The capon will cluck to the chicks, and treat them even more kindly than a hen.

After the capon adopts one batch of chicks, keep it under the box with the brood for a full day, and give only a few bread crumbs and a little water. The box should be kept dark and far enough away from the hen to prevent the chicks from hearing her call. After this day of confinement, the capon and its brood may be placed in an open coop, where they should be confined for several days before being allowed to roam at will.

When the chicks are large enough to be taken away from the capon, a new brood may be given to the bird, provided the exchange is always made at night. In this way a single capon will be able to raise a comparatively large number of chicks.

9. Varieties and Crosses Most Suitable for Caponizing. While any male bird of any breed will be improved by being caponized, some varieties will make larger and better capons than others, and as it is only the finest capons that bring the highest prices, the breed of fowl for the operation should be carefully selected. In American markets, especially in the East, capons with yellow skin and fat will sell the best, while the white-skinned birds with white fat will sell best in European markets.

10. Capons for the family trade, weighing from 6 to 8 pounds, can be obtained with best results from cockerels of three of the American breeds, Wyandotte, Plymouth Rock, and Rhode Island Red, and from three of the English breeds, Orpington, Dorking, and Sussex. Capons for the highest-priced trade of February and March, weighing from 8 to 11 pounds, can be made to the best advantage from Asiatic cockerels, Brahmas, Cochins, and Langshans, which rank in the order named. For the very choicest capons having rich yellow skin and legs, the Brahmas and Cochins will be found to excel.

Several crosses between these breeds are also suitable for the production of very superior capons. A first cross between a Light Brahma and a Dorking makes a magnificent capon and is large in size and fine-fleshed, with rich yellow skin and legs. Cockerels from a cross of a Plymouth Rock and a Light Brahma or a Plymouth Rock and a Buff Cochin make good capons, but they are not so large nor so fine in quality as those mentioned above.

11. The Plymouth Rocks and the Asiatics are the easiest cockerels to operate on, because they develop their frames first and do not grow much flesh until after they have passed the size best suited for caponizing. When these birds weigh from 2 to 3 pounds there is little except skin over the ribs, and the spot to cut when caponizing can be easily located with the eye. Cockerels of the small breeds like Leghorns, Hamburgs, and Bantams should not be caponized, at least by the amateur, as the operation is difficult to perform on these birds and, besides, the gains that result from it are small.

12. Age of Cockerels for Caponizing.—Cockerels of the breeds best suited for caponizing may be operated on at any age between 2 and 4 months, but the operation is most advantageously performed just before the combs of the cockerels begin to shoot, or grow rapidly. At this period the birds will be about 10 weeks to 3 months old. Cockerels that are 4 months old or older should be caponized by experts only, as at such an advanced age the operation frequently proves fatal. Generally speaking, the younger the birds are the easier will be the operation and the quicker the recovery; young cockerels have but little flesh over the ribs, hence the ribs can be very clearly seen and the cut can be made very accurately.

INSTRUMENTS AND APPLIANCES FOR CAPONIZING

13. Instruments used for caponizing are manufactured by several firms, but the different sets do not vary greatly either in style or in price. The essential instruments are a *knife* for making the incision, a *spreader* for holding the ribs apart, a *hook* for tearing the inside membrane, a *probe* to push aside the intestines, a pair of *forceps* for removing foreign matter that may get into the abdomen, and a *cannula* or a *slotted scoop* for removing the testicles.

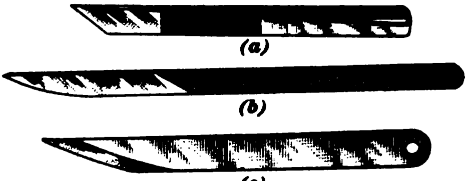

FIG. 1

14. A **knife** for caponizing should be pointed like one of those shown in Fig. 1. The knife should, of course, be as sharp as possible. Some makers of caponizing sets furnish a knife like the one shown in (*b*), but experienced operators usually prefer a knife shaped like the one shown in (*a*) or the one shown in (*c*). An ordinary pocket knife is sometimes used, but the material in the ordinary knife is not usually good enough to hold as keen an edge as is necessary for the operation.

15. In Fig. 2 are shown several types of spring **spreaders** for holding the ribs apart while the operation is being performed. Formerly whalebone or wooden spreaders were used for the purpose, but the work is much better performed with the modern spring spreader, of which there are a number of acceptable types.

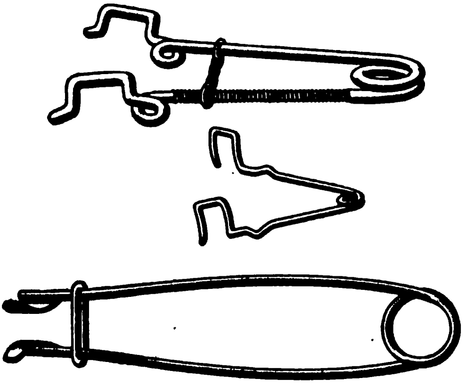

FIG. 2

16. The **hook**, which is shown in Fig. 3 (*a*), is used for tearing apart the membrane that envelops the intestines, and should be delicately pointed. The **probe**, which is shown in Fig. 3 (*b*), is used to push aside the intestines when search-

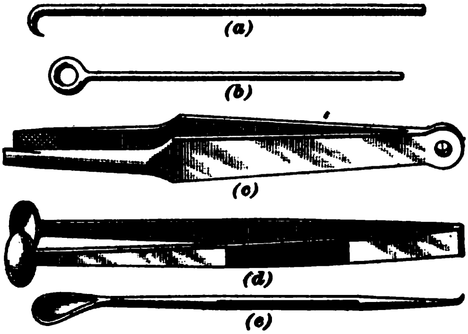

Fig. 3

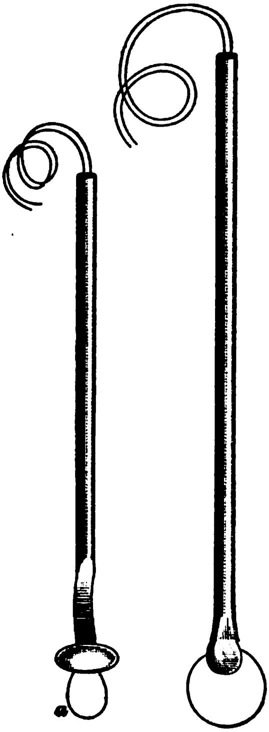

Fig. 4

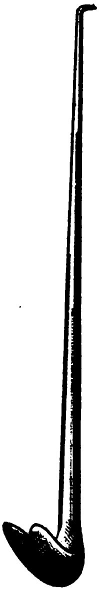

Fig. 5

ing for the testicles. The **forceps,** which are shown in Fig. 3 (*c*), are used to remove any foreign matter, such as feathers or bits of dirt, that may drop into the abdominal cavity. The forceps are also useful in handling the lint or sponge that is used to remove any blood which may appear in the cut. An improved type of forceps, known as the **spoon forceps,** is shown in Fig. 3 (*d*). A combined hook and probe is shown in Fig. 3 (*e*).

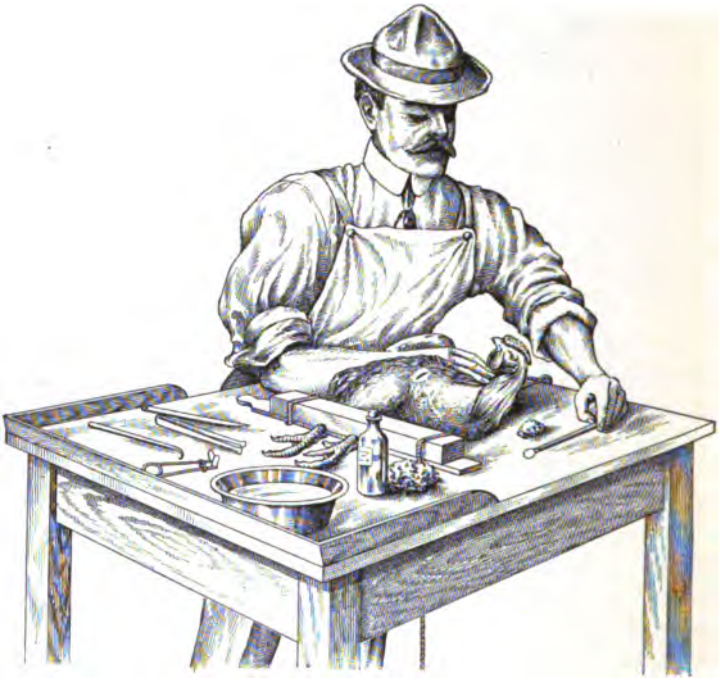

FIG. 6

17. The instrument by which the testicles are actually removed is the **cannula,** which is shown in Fig. 4. The cannula consists of a brass or nickel tube about 5 inches in length, through which a piece of horsehair or fine wire can be run, as shown in the illustration. In using the cannula, the loop *a* of the horsehair or wire is slipped over the testicle, which is gently twisted and torn away. A **slotted scoop,** such as shown in Fig. 5, is sometimes used in place of the cannula.

18. Besides the instruments mentioned, the person doing the caponizing should be provided with an *operating table*, a means of securing the cockerels to the table, *cold water*, *carbolic acid*, or some other equally efficient sterilizing medium, a *wash basin* or *bowl*, a *large sponge*, *small pieces of sponge* or *absorbent cotton*, and a *needle* and *white silk thread* for stitching.

19. The cold water and the sponge are used for washing the plucked area where the incision is to be made, though this need not necessarily be done. The carbolic acid or other germicide is for sterilizing purposes, and should be added to the water so as to make a 5-per-cent. carbolic-acid solution. This strength of solution is most used for such operations; less than 2 per cent. is too weak to be effective in this case in destroying germs. The use of the small pieces of sponge or the cotton is to absorb any blood that may be spilled in the operation, and they should be sterilized by moistening with the carbolic-acid solution. The same 5-per-cent. carbolic-acid solution should also be used to sterilize the instruments.

20. A barrel may be used as an operating table, but it is advisable, particularly where much work is to be done, to have a table that is made especially for the purpose. A table about 3½ feet long and from 18 to 20 inches wide will be found to be of the most convenient size. The table shown in Fig. 6 is provided with a top that may be tilted to insure a good light; the top is also provided with slots and weights for holding the fowl in position. A box or bench for holding the instruments and appliances should be placed near the operating table, which should be made high enough so that the operator will not be obliged to stoop much.

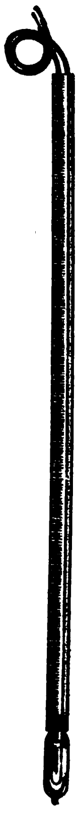

FIG. 7

21. A small electric light such as shown in Fig. 7 is handy for illuminating the abdominal cavity; by its use caponizing can be performed in the evening or on dark, cloudy days.

OPERATION OF CAPONIZING

22. Qualifications of an Operator.—The operation of caponizing is very simple when the principles and essential details connected with it are clearly understood, and after a little practice the operation can be performed by any one who is not nervous and liable to get agitated or excited when cutting into the body of a living animal, and who is not made sick at the sight of a little blood or by the peculiar smell that arises from the organs of the body of a fowl when they are exposed to the air. The faculty of not being nervous is the most important of the above; nervousness and consequent hurry are liable to cause mistakes that will result fatally. There is a great difference between working rapidly and working hurriedly, and some persons are never able to compose themselves while cutting a living creature; though after a time it is possible for almost any person to become accustomed to the sight of blood and the smell arising from the exposed organs of the body.

If the beginner will thoroughly master the detailed instructions that are given in the next few pages, it should not take longer than 10 minutes to caponize the first cockerel he has to handle. An expert can handle as many as 15 to 20 cockerels an hour. Some poultrymen advise that the beginner make his first attempt on the body of a dead cockerel, though this is not necessary unless the novice feels timid.

23. Conditions Essential for Successful Operation.—Two conditions are essential for successfully caponizing cockerels: The intestines of the fowl must be well emptied of food, and there must be an adequate supply of light, either natural or artificial, at all times during the operation.

If the intestines are empty when the operation is performed, they are not in the way of the operator and are not likely to get punctured by a slight slip of the knife, as would be the case if they were full. A puncture of the intestines will almost certainly result in the death of the chicken. To get cockerels in the best condition for caponizing, they should be starved for a least 24 hours prior to the operation, and a fast of 36 hours will put them in still better condition. Thus, if the poultryman is planning to caponize on Friday, as is the custom on many poultry farms, the cockerels intended for this purpose should be selected on Wednesday evening, shut up in a roomy coop, and given neither food nor water until after they have been operated on.

As the operation should be performed only in a bright light, if the day set for the work proves to be too dark and there is no electric or other bright light available, no harm will come to the cockerels if the operation is postponed until the next morning.

24. **Preparation of Cockerel for Operation.**—The cockerel is secured and held firmly in position for the operation of caponizing in several different ways. A very satisfactory method is illustrated in Fig. 6; here the shanks of the chicken are shown held in a clamp, a noosed cord being slipped over the wings and tightened at the shoulders close to the back and then going over the edge of the table; the bird is held down by the pull of a weight at the lower end of the cord. Another method is to use two noosed cords with weights of about a pound each fastened at the ends opposite from the nooses. One of the noosed ends is then slipped over the feet and shanks of the bird and fastened around both legs above the hocks. The other cord is slipped over the wings, and then the weights at the ends of the cords are lowered gently over the sides of the table, and the cockerel is held in position, usually with the right side exposed to the operator. The weights stretch the cockerel so that its side muscles are fairly tense and in the best condition to be cut.

When the cockerel is in the proper position, the area immediately surrounding the spot where the incision is to be made is quickly plucked clean of feathers, as shown in Fig. 6.

25. **Method of Locating Point for Incision.**—The making of the cut in caponizing is the real factor in the success of the operation, and the location of the exact spot where the cut is to be made requires the greatest care. When the cut

is made in the right place the testicles can be found readily. When the cut is made too far forwards or too low down, it is difficult to locate the testicles and there is proportionately more difficulty in removing them.

The cut should be made between the sixth and seventh ribs—the ribs nearest the hip—and between the angle in the ribs and the backbone, as shown by the heavy dotted line in Fig. 8. These two ribs are the floating ribs; that is, one end of these ribs is attached to the backbone and the other end is unattached. The other five ribs are attached at both ends—one end to the backbone and the other end to the breast bone.

If the cut is made in the proper place between the sixth and seventh ribs it will be directly above the testicle, and this is the only spot where it can be made with entire safety and to advantage. If a mistake is made in locating the spot to cut and the incision is made between the fifth and sixth ribs, the knife will cut above the membrane that separates the thorax, or chest, from the abdominal cavity and the testicle will not be in sight. Another cut will have to be made; this may be made through the membrane or a new cut made between the sixth and seventh ribs. It is difficult to remove the testicles from an opening between the fifth and sixth ribs and the lungs may be punctured if the cut is made there.

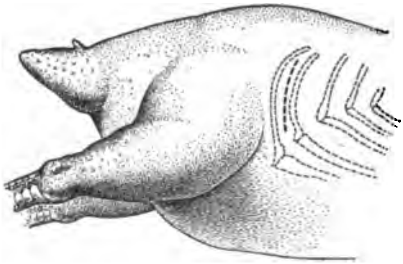

Fig. 8

26. To locate the exact spot at which to make the incision place the first finger of the left hand on the body of the cockerel directly above the thigh. Pass it slowly with a gentle pressure toward the head of the fowl until the first obstruction is met. This will be the seventh rib of the cockerel. Slip the finger over this rib and press the tip of the finger down firmly between the two ribs at a point about half way between the angle of the ribs and the backbone to serve as a guide for cutting.

27. Method of Making Incision.—The operator is now ready to make the incision. Keep the finger that is pressing down between the sixth and seventh ribs firmly in place and insert the knife to a depth of ½ inch, with the cutting edge toward the breast bone. To aid the beginner, a scratch can be drawn across the knife blade ½ inch from the point. Draw out the knife, but still hold the finger firmly in place; turn the knife blade around and again insert it with the cutting edge toward the backbone; cut along between the ribs until the backbone is very nearly reached.

The experienced operator need not make the cut more than 1 inch in length, but the beginner should make it as long as the space between the angle in the rib and the backbone will allow, and then put a stitch in the middle of the cut after the operation is finished. The operator must be careful to cut in a line with the veins, not crosswise of them, and not too near the backbone.

By pressing the tip of the finger between the ribs during the cutting operation, the skin is held taut and prevented from slipping back and forth and increasing the chance of having the cut made in the wrong spot.

28. Method of Removing Testicles.—As soon as the cut is made, the knife is laid aside and the spreaders inserted in the wound. The sixth and seventh ribs are held securely by the hooks at the end of each arm of the spreader, and the spring of this instrument is allowed to separate the ribs far enough to make an opening of ¾ inch. When this point is reached the spreader should be locked by means of the catch. If the spreader will not remain in place of itself it must be held in place with the hand not employed in removing the testicle, which is usually the left hand.

Looking down into the cavity, the film-like membrane that encloses the abdominal organs will be seen. This is usually severed by the knife during the cutting; if not, the knife should not be used again, as there is danger of cutting the intestines, because they lie very close to this membrane. The membrane should be torn apart by means of a hook similar to that shown in Fig. 3 (*a*). This hook must be used carefully, or an artery or an intestine wall will be punctured. If at this stage of operation there is so much blood in the wound as to make the organs indistinct, it should be sponged up.

29. If the cockerel has been starved sufficiently so that the intestines are practically empty and lie down and away from the backbone, after the membrane is ruptured, the right testicle will be in plain view up against the backbone. The testicle is a small bean-shaped organ, yellowish or yellowish white in color. It is attached to the backbone by means of small ligaments. Directly below the testicle is a comparatively large artery, which may be ruptured and cause the cockerel to bleed to death unless the operator is careful.

If the intestines hide the testicle from view, either because they are too full of food or do not lie in the proper position from any other cause, they should be pushed gently toward the breastbone by means of a forceps or a probe similar to those shown in Fig. 3. This will always uncover the testicle.

30. Either the cannula or a pair of forceps is commonly used to disengage the testicle from the backbone and remove it from the interior of the cockerel. If a cannula is used, insert it in the cavity, slip the wire loop in the end over the testicle, and draw the wire tight. Do not jerk, but with a slight twisting motion work the cannula back and forth to assist in detaching the ligaments that hold the testicle. If drawing up on the wire does not sever the cord and loosen the testicle, twist slightly from one side to the other until the testicle is free. When working with a cannula, particular care should be taken to see that the artery beneath the testicle is not torn or injured in any way. Sometimes the loop of the cannula takes hold of the membrane of the artery as well as the cords of the testicle, and this draws the artery out along with the testicle, causing a rupture in the artery wall. With a little experience and practice this does not often happen, but when it does the bird bleeds to death very quickly.

If the forceps are used they should also be held in the right hand and inserted in the wound slightly opened. Take a firm grip with the spoons of the forceps on the cords below the organ and with a half turn the testicle is severed from its support, and it can be drawn out and thrown away.

If a slotted scoop is used, this instrument is lowered into the cavity and placed below the testicle. Then it is moved so that the cords back of the testicle are slipped into the slot in the center of the scoop. These cords are severed as the scoop is pulled upwards and the testicle is left lying in the scoop of the instrument.

31. To take out the second testicle, the operation is duplicated on the opposite side of the fowl. This method is always recommended for novices in the work. However, when the operator becomes experienced, the left testicle can be taken out through the incision made to remove the right testicle. In this case, the lower, or left, testicle is always removed first, as it is the most difficult to remove. After the right testicle is seen against the backbone, take the probe or the forceps and push the bowels gently away from the backbone, and the left testicle will be seen immediately below the right one, on the opposite side of the slight ridge of bone in the center.

32. Details to Be Observed During Operation.—No matter how the work of removing the testicles is done, both testicles should be entirely removed, as the slightest particle left will cause a growth of the reproductive organs, and result in the production of a *slip*, which is a bird that is part cockerel and part capon, but which will not fatten any better than a cockerel, nor produce any better quality of meat; it will also resemble a cockerel in being quarrelsome. Slips look like imperfectly developed cockerels, and will usually crow and molt like cockerels, whereas capons seldom crow or molt.

The slip shown in Fig. 9 came from the same flock as the Plymouth Rock capon shown in Fig. 10, and was one of the most promising of a large lot of fowls when newly caponized. Where caponizing is done on a large scale there is likely to be

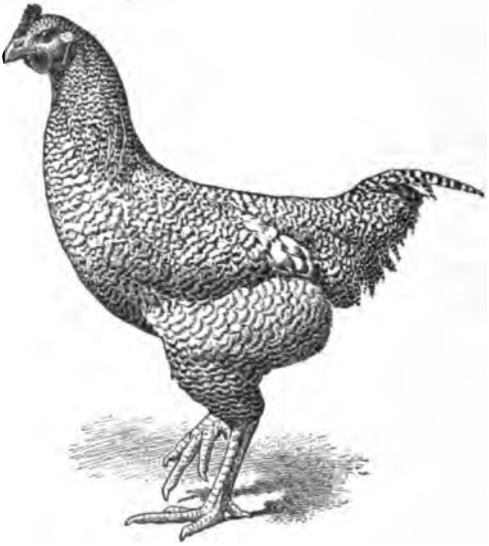

FIG. 9

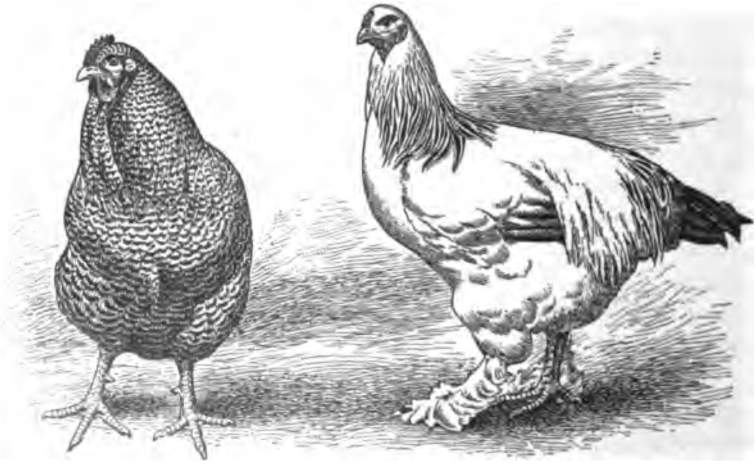

FIG. 10

a considerable number of slips. They are useless products as compared with capons, and should be disposed of as ordinary dressed poultry as soon as their true nature is discovered.

33. If a large incision has been made in the bird, it may be sewed up with white silk thread, though this is not considered essential by many poultrymen. One stitch is all that is necessary, and this should be taken in the middle of the cut. Only the skin should be sewn; if the flesh is caught by the thread, the slightest movement of the fowl will tear the stitching out. The sewing is best done with a slightly curved surgical needle, but an ordinary needle may be used. A skilful operator makes a small incision and very seldom stitches.

Care should be taken to see that no particles of dirt or feather fall into the cavity. If any foreign substance accidentally finds its way into the cavity, it should be promptly and carefully removed with the forceps.

If a small blood vessel is cut, the blood should be sopped up with a bit of sponge or absorbent cotton held in the forceps. The sponge or cotton should be rinsed in the antiseptic solution each time it is used.

34. Treatment of Capons After Operation.—If the operation has been successful, the newly caponized bird will almost immediately have a passage from the bowels. On being released from the operating table, capons should be put in a pen by themselves, where other fowls will not be able to molest them. Here they should almost immediately be given a feed of soft mash and plenty of water. Some poultrymen keep them confined in a pen by themselves for 2 or 3 days, while others let them run at large after an hour or two. By keeping them confined for at least an hour or two the operator can watch them and if any grow weak from internal bleeding, they can be immediately killed and dressed for market. After 2 days the capons may be given their liberty, but it will prove most satisfactory if they are not permitted to roost for a few days longer.

35. After the operation of caponizing, a gas is given off inside of the body of the chicken, and if the wound heals too rapidly the bird will become puffed up, suffering from what are commonly known as "wind puffs." The capons should be examined every day for a week, and any wind puffs should be pricked with the point of a sharp knife blade or with a needle, to allow the gas to escape.

After successful caponizing, the fowls do not need medical attention, for the testicles are not vital organs and their removal alone does not affect the health of the bird for any length of time. Neither is the film-like membrane enclosing the bowels a vital part, and the cut through the skin and muscle between the ribs is a simple flesh wound. Unless some foreign matter falls into the wound or a large blood clot forms, there is little danger of blood poisoning. The skin will heal up rapidly and the bird will fully recover in 2 or 3 days.

CARE AND FEEDING OF CAPONS

36. The care and feeding of capons is essentially the same as that given soft roasters. After the first few days there is no difference between the food given to capons and that given to other fowls, but during the first few days after the operation soft food should be given to them. As the birds have been without food for from 24 to 36 hours or more by the time they are released from the operating table, they are quite hungry, and care should be taken to see that they do not overeat and thus distend the intestines. For a day or two capons should be given a small amount of food five times daily. This feed may be composed of ground meals with a little salt in it, given in the form of a moist mash. An English ration is made of soaked biscuit meal dried off with middlings or ground oats with about 10 per cent. of meat meal added. While confined, the capons should also be given bone meal, broken shell or grit of some kind in small quantities, and plenty of fresh water. After the first week they may be given all the food they will eat. They will be ravenous for a month or so, and then will gradually ease up in the amount of food they consume.

Capons should be fed for frame growth until about 6 weeks before they are to be marketed. Then the quantity of corn meal or whole corn should be doubled and the quantity of meat meal or meat scrap gradually increased until it forms about 20 per cent. of the total food fed. This fattening ration should finish the capons in good condition in from 4 to 6 weeks.

37. As an instance showing what can be done in fattening capons for market, the following case may be taken: The flock in question consisted of 114 cross-bred Cochin and Langshan capons that averaged a little more than 14 pounds each in weight at 10 months of age in the month of April, and were sold for 24 cents per pound live weight. This entire lot of capons had the freedom of an open shed, one-half of which was enclosed for a sleeping room, and from the first of December until selling time their exercise was obtained in an enclosure 60 feet square. The cockerels from which the capons were produced were hatched by hens in June of the previous year, and both chicks and hens were given the freedom of a large field until the time for caponizing arrived. From that time on the capons were more or less restrained throughout the entire winter.

Capons will take but little exercise beyond what is necessary to obtain their food and to select the most convenient and best sheltered spot where they can bask at their ease in the sunshine. The only time they take considerable exercise is when there is a scarcity of food.

38. Good types of well-fattened market capons are shown in Fig. 10; both of these came from pure-bred stock. The one at the left is a Plymouth Rock and the one at the right is a Light Brahma. The Plymouth Rock is very full-breasted, plump, and fit for the spit. The Brahma capon has a large frame and although of good size at the age of 6 months, heavy feeding for 3 or 4 months longer would materially increase its weight and improve its quality.

When well fed and properly cared for, capons have a profuse, glossy plumage, but when the opposite conditions exist it is evidence of poor care and feeding, and the chances are that capons that are not well cared for will be produced at a loss.

39. As capons can be produced at a good margin of profit only where there is a ready market for them at 20 cents, or more, per pound, live weight, the production of capons for market cannot be recommended for all poultry farmers. In some instances it will be found more profitable to dispose of the cockerels when they are from 3 to 4 months old. Capons can be most economically and successfully produced where poultry forms only one part of the stock that is maintained on the farm, or else on farms where they can have a large area over which to roam and forage. With an extensive range they will be able to pick up a great deal of food for themselves, but if all the food they eat must be purchased, the margin of profit will not be so large.

The reason for this is that capons have to be fed for about 5 months longer than it is necessary to feed cockerels to bring them to market condition, and the purchase of feed for them during that period will greatly reduce the margin of profit as compared to that of range-grown capons. Capons will put on flesh and increase in value on an open range where cockerels would take so much exercise that their flesh would become hard and stringy.

Capons do well on the range when they can be turned out on stubble after the harvest from a grain field, and can be later allowed to run over newly ploughed land or pasture. Under such conditions they will gather for themselves a considerable portion of the food they require to keep them growing steadily until it is time to fatten them for market. Capons can also be produced with profit on a farm where market gardening is practiced, for on such a farm a large amount of their food can be made up of unmarketable vegetables, which can be cooked and mixed with fattening meals.

OPERATION OF POULARDIZING

40. The operation of poulardizing is, in a general way, similar to that of caponizing, and by those who are familiar with it it is said to be much easier to perform. The same instruments are required for the operation and the only difference is in some of the details of the cuttings. In poulardizing, the cut in the side of the pullet is made, as in the cockerel, between the sixth and seventh ribs, but closer to the backbone. After the opening is made, the lower bowel, or rectum, is exposed to view. This should be drawn aside so as to expose the oviduct, which lies below it. The oviduct is then lifted by the forceps until it is drawn out of the incision, and severed near its junction with the ovary, but the operation is more effective if a small section of the oviduct is entirely removed. After poulardizing, the development of the ovary is entirely prevented.

Some years ago French operators made a practice of removing the egg cluster from the pullet, but in recent years this has been discontinued as unnecessary. It is essential that the operation be performed before the pullets are ready to lay.

Poulards grow rapidly and to a larger size than pullets. The flesh, like that of capons, is tender and juicy. Poulards are liable to be plumper and, consequently, to present a better appearance than capons.

FATTENING, OR FINISHING, OF POULTRY FOR MARKET

41. Advantages of Special Fattening of Poultry.—One of the most profitable branches of poultry farming is the special fattening of fowls for market after the birds have reached the stage at which they are ordinarily sold. The requirements of the best markets are exacting, and comparatively few poultrymen produce the kind of market poultry that is most in demand and for which the highest prices are paid. While cattle, sheep, and hogs are generally fed more or less scientifically so that they will be in the prime condition necessary to bring the best prices, poultry is ordinarily marketed in a condition much inferior to that which it is possible to attain by even a short period of scientific fattening.

The best grades of market poultry are secured only through a special system of fattening the fowls to increase the quantity and improve the quality of the meat. It might be supposed that a fowl so fat as to be hardly able to walk would be well fattened. This, however, is not necessarily true. The fat may be present internally in large lumps, in which case it would be lost as offal in dressing and would have but little influence in improving the quality of the flesh. In a properly fattened fowl, the fat is distributed in small particles all through the fibers of the meat, and when in cooking the fat melts it is in the best location to soften the fibers and to render them more tender and better flavored. The flavor of the meat of a properly fattened fowl is so superior to that of the ordinary farm-raised fowl as to place it in an entirely separate and distinct class.

42. There is a great opportunity for firms or individuals to conduct fattening establishments in localities where large numbers of fowls are grown on farms and but little care is given to them. In such a plant the fowls could be specially fattened for market after they are taken from the range and the value of the product greatly increased. The average weight of the ordinary fowl as it comes from the farm is about 3 pounds, or 48 ounces; of this there is about 25 ounces of bone and waste and 23 ounces of meat. If a fowl of this kind is properly fattened, it should range in weight from 4½ to 5 pounds, and the meat will be much improved in quality and will sell for a higher price per pound.

43. In fattening poultry for any particular market, the first essential is to cater to the demand of the market in regard to the color of meat desired. The color of both the flesh and the skin of fowls is influenced largely by the food they eat. Although a fowl may naturally have either yellow or white skin or flesh, the color of both can be changed through judicious feeding to secure the color desired. In some markets, the demand is for yellow meat exclusively; in other markets, only white meat will bring the best prices; while in still other markets not so much attention is paid to the color of the meat as to its quality. The rations that are used to influence the color of the meat of poultry are given in a subsequent paragraph.

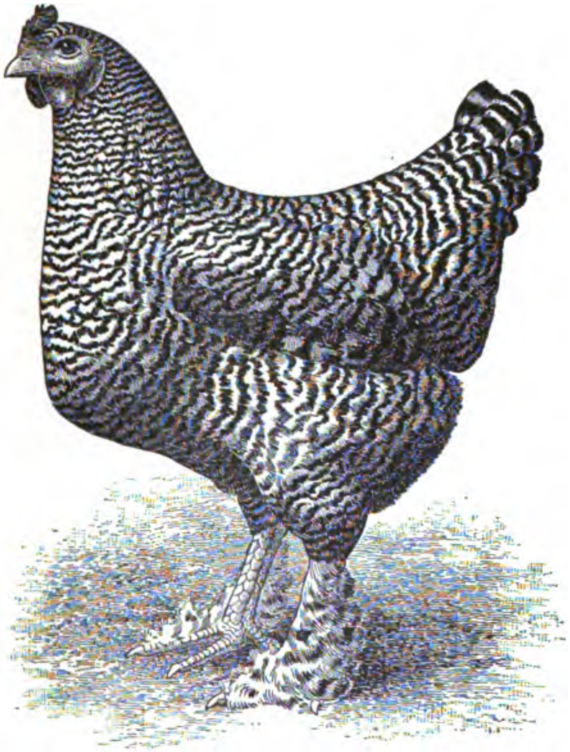

Fig. 11

44. Appearance of Fattened Poultry.—It is not at all unusual for the best fattened South Shore poultry to sell in the Boston market for 50 cents per pound. The best market poultry produced in England and France and the Belgium market breeds known as La Bresse and Cocou de Malines sell for even higher prices. The natural body formation of the

Cocou de Malines shown in Fig. 11 is well suited to the shaping board, the use of which is described elsewhere. A plump fowl like the one shown can be had only as a result of proper fattening. When killed and dressed for the market, the carcass will appear as shown in Fig. 12. There is almost no indication of breast bone and every portion of the body is well filled with flesh. When properly fattened, the back as well as the breast will be plump and full, as shown in Fig. 13. The greater portion of all market poultry should be fattened like this. Thin or lean specimens should not be killed, as they are nearly a total loss if there is more bone and waste than meat. In any case but small prices would be received for them.

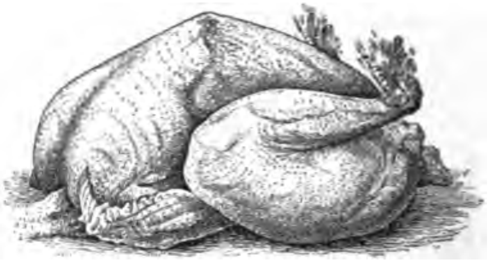

Fig. 12

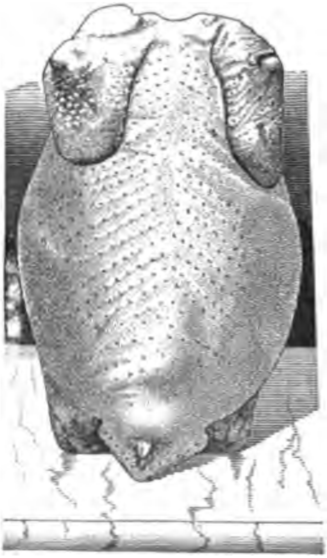

Fig. 13

45. An average sample of the best grade of American market poultry is illustrated in Fig. 14. The specimens shown are Plymouth Rocks, and with the exception of one point, the too prominent breast bone, they might serve as a standard for quality. The covering of the breast bone with edible meat, so desirable in market poultry, can be accomplished with the American breeds in the same way as it has been done with other breeds—by the selection and use of only the most desirable specimens for breeding stock. The poultry shown in Fig. 14 has been well fattened and the crop was empty when the birds were killed. An ideal specimen, such as can be made of any one of the American breeds or varieties, is shown in Fig. 15. In this specimen there is little or no prominence of breast bone; the entire carcass is plump, with no indication of fat in the abdomen. The real value of quality cannot be overestimated, as market poultry of the better kinds sells quickly in each and every locality and at prices far in advance of the inferior quality. The fowls of Sussex, England, and the poultry districts of France have become famous the world over, simply because they have been well bred, properly fed and fattened expressly for the market.

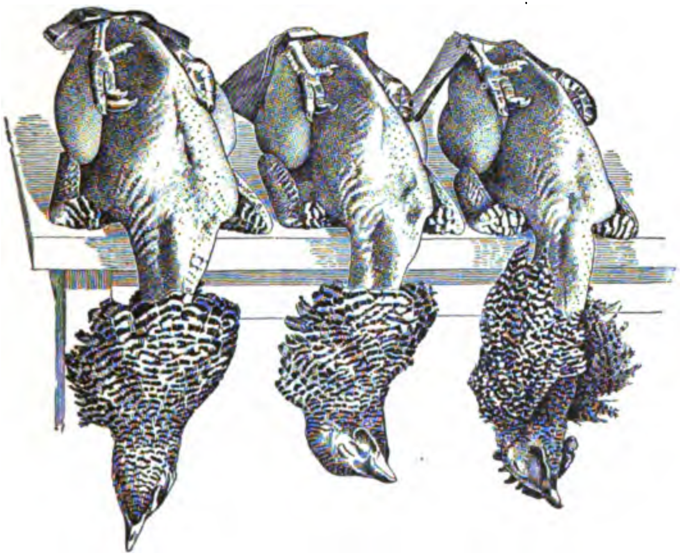

FIG. 14

46. Systems of Fattening Market Poultry.—By far the largest part of the poultry sent to market is from farms where the fowls have the full run of a large area, and these birds are thus known as range fowls. Fowls that come from farms where poultry is the main product supply a relatively small part of market poultry.

Three systems of fattening for market fowls that have been previously raised in any way are commonly practiced. These systems are as follows: *Range fattening*, *yard fattening*, and *crate fattening*. As employed on many farms, these systems may be more accurately termed stages of the fattening process, for the reason that no particular one of the systems is often rigidly adhered to on any one farm. For instance, some fowls are simply range-fattened before killing; in other cases the fattening process is carried further and the fowls are more completely fattened by a more or less protracted period of feeding in yards or in crates. The degree of success attained in fattening fowls depends on two things,

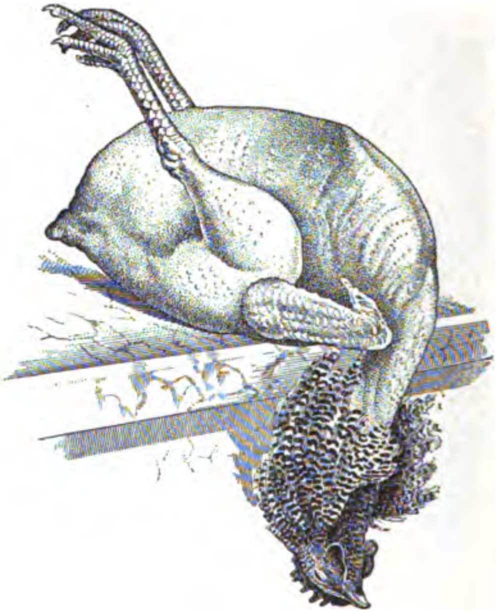

Fig. 15

namely, the *quantity of fattening food* that is fed to the fowls and the *amount of exercise* they are allowed to take.

47. Range fattening consists simply in giving the fowls a quantity of fattening food for a few weeks to increase their weight to some extent before they are killed for market. In **yard fattening,** the fowls are given fattening foods as in range fattening, but, as their exercise is materially restricted, there is a greater gain in weight, and the quality of the flesh is also improved by the softening of the muscles. The very best grades of market poultry, however, are finished by **crate fattening.** By confining fowls in crates, or coops, exercise is almost wholly prevented. They are given all the fattening food that they will consume, and, as a final step, forced feeding is sometimes resorted to.

48. Persons inexperienced in the business of poultry fattening will accomplish more by yard fattening than by crate fattening, as in yard fattening the poultry will have exercise enough to keep them from losing their appetites readily, but still will not get enough to harden their muscles. If the beginner desires, he might select a few birds and try to fatten them in crates as an experiment, while he is fattening the greater part of his flock in yards. In a case of this kind, it will usually be found better to start the fattening in small yards, and to finish it by trough feeding in crates. Forced feeding should not be attempted until experience has been gained.

RANGE FATTENING

49. Usually, range fowls are left to pick up most of their food wherever it can be found about the farm, and little attention is paid to the flock beyond feeding a little grain once or twice a day. Range fowls, as a rule, have rugged constitutions, but as they have not been fed any great quantities of fattening food, and as they have had unlimited exercise, their flesh is hard and stringy and also lacking in quantity. The greater number of range fowls come from farms where from 100 to 500 fowls are kept as a side issue to the regular business. Often such fowls are killed for market only when they are too old to be useful or when it is desired to thin out the flock.

As already stated, poultry, in order to command good prices, should be in a plump condition when sent to market. Farm-raised fowls are fattened to a certain extent by feeding them fattening foods on the range for a time before they are to be killed for market. The degree of plumpness attained depends largely on the length of time the fowls have been fed especially for fattening, but as they are not restricted as to exercise the gain in weight is not all that could be desired nor is the quality of the flesh materially improved.

YARD FATTENING

50. Range-grown poultry of the proper pure-bred market type is always best for yard fattening; there is little or no use in trying to make good specimens of market poultry by fattening mongrel stock. In the production of yard-fattened poultry, good individual specimens should be kept inside of small enclosures. By only a few weeks of judicious feeding the birds will make surprising gains in weight and the quality of the flesh will be remarkably improved. Flesh grown in this way costs a third less than that produced by fattening on the range.

51. Arrangement of Yard.—A yard intended for fattening fowls for market should have only sufficient room for the birds to move about in. The size of the yard is best determined by the number of birds to be fattened; 6 or 8 square feet should be allowed for each fowl. The shelter for the fowls may be simply a coop made out of a packing case or it may be a small building, or a fattening shed.

The yard and the house must be kept clean. The floor of the house should be covered with dry earth or sand, over which should be placed a layer of straw. This floor covering should be changed as often as necessary to keep the place in a sanitary condition. No roosts are needed, as the fowls rest on the floor at night.

Fowls confined in the limited quarters described should have a plentiful supply of fresh air at night and the freedom of both the house and the yard during the day.

52. When the colony system of poultry raising is followed on a farm and it is desired to yard fatten any surplus fowls before sending them to market, the fowls can easily be confined in close quarters by setting a movable fence about each colony house. After a week or two of such confinement, while being fed fattening foods, the quality of their flesh will be greatly improved.

53. Feeding of Fowls in Fattening Yards.—Fowls confined in fattening yards should be fed three times a day and should have all the food they will eat up clean, without being fed so much that they will leave any of the food. The food should consist of mash, cracked corn, wheat, and some animal food. The mash should be made of 2 parts of finely ground oats or barley from which the hulls have been removed, 2 parts of corn meal, and 1 part of wheat middlings, all mixed with hot milk or boiling water. Milk is preferred to water for mixing and the mash should always be fed while moist and warm.

A full meal of the mash is fed in the morning and at noon. At night the fowls should have a grain mixture consisting of equal parts of cracked corn, wheat, and hulled oats. No meat will be needed during the first week if the mash is mixed with milk. After the first week, 5 per cent. of the mash should consist of meat, and some fat can also be added to it. The meat must always be sweet and clean and free from bad odors. Green food is not needed. Water and grit must be kept before the fowls continually.

This system of feeding should be continued until the fowls are ready for market. Some will take only about 18 days to get into good condition for killing, while others may not be in prime condition in less than 28 to 30 days. As the fowls ripen, or finish, they should be disposed of. None should be fed beyond 30 days, as the fattening after this length of time will be done at a loss.

It is possible by this method of feeding in yards to increase the original weight of a fowl by 50 per cent. in 3 weeks. To do this, the fowls must be kept quiet all of the time. They must not be frightened or annoyed, and the meals used must be finely ground and all hulls or husks removed.

CRATE FATTENING

54. Advantages and Method of Crate Fattening.—The system of **crate fattening**, which consists in finishing the fowls for market while confining them in crates or coops, gives much better results than either range or yard fattening, provided the system is properly carried out. The best grades of market poultry are secured through following yard fattening by careful feeding in crates, where the exercise obtainable by the fowls is reduced to a minimum. Less room, food, and labor will be needed for the practice of crate fattening than for the other fattening methods; still the poultryman who tends the fowls must have a full knowledge of the system or failure will follow.

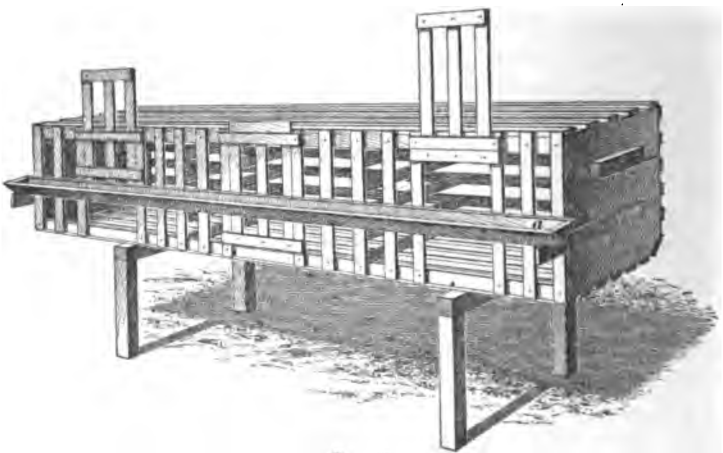

FIG. 16

The crates must be made as later described, and care should be taken as to the selection of fowls that will stand the strain of this method of fattening. Strict attention should be given to the health and general condition of each bird. No ailing fowls should be left in the crates; if any become sick or indisposed, they should be liberated in a yard until they fully recover. Coarse grit or gravel is an absolute necessity at all times. No vermin of any kind should be permitted to harbor on the birds or in or about the crates. Good care is of an importance almost equal to that of good food; without such care fowls will never fatten well.

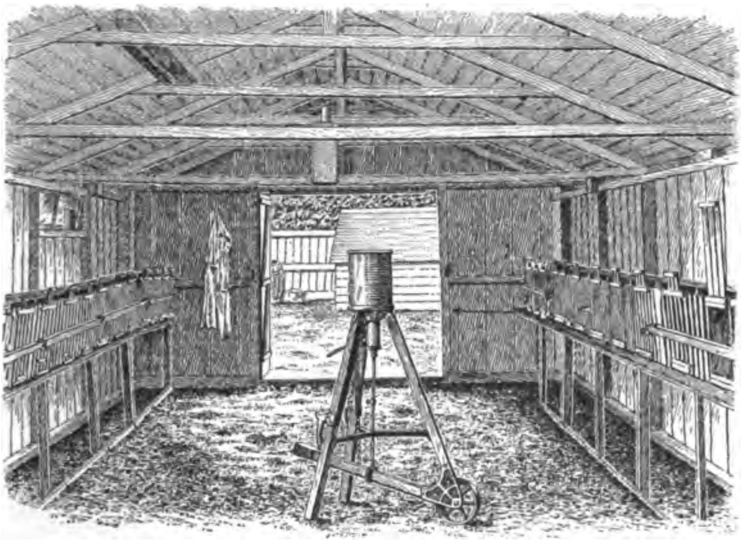

FIG. 17

55. Fattening Crates.—In the modern system of crate fattening, use is made of special fattening crates. To be well adapted for the purpose intended, a fattening crate should be from 18 to 20 inches high, 18 inches wide, and from 6 to 12 feet long. The crate should be divided into compartments 2 feet long, each compartment being designed to hold from three to six birds, the number of fowls in a compartment being governed by the size of the birds. The fowls are more contented when several are together in this way than if they are placed alone in single coops. Fig. 16 shows a crate 6 feet long and made of slats 1½ inches wide and ⅝ inch thick, with the exception of the bottom slats, which are 1 inch wide and ½ inch thick. The top, back, and bottom slats run lengthwise, and the front slats run vertically. The front, top, and back slats are 2 inches apart. The bottom slats are placed ¾ inch apart to allow the droppings to fall through. The feed trough *a* can be removed from the crate when desired.

All food and water given the fowls should be placed in a trough or troughs on the outside of the slats, and these troughs should be hung high enough above the bottom of the crate to prevent filth from getting into them.

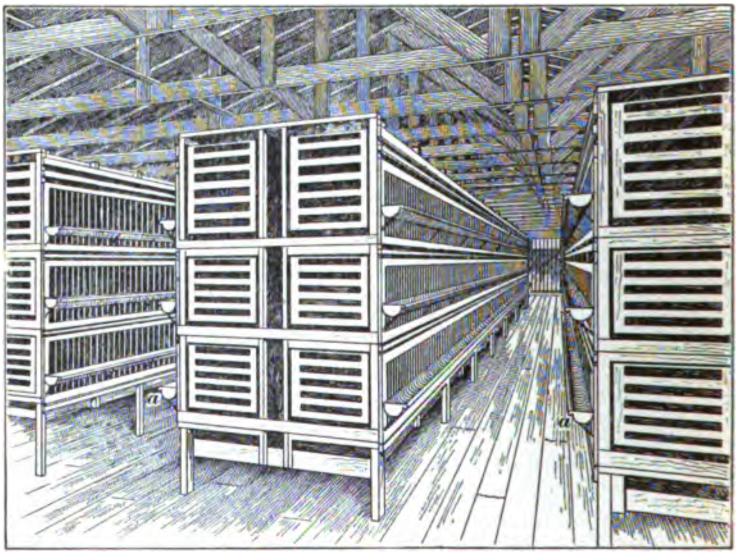

FIG. 18

56. Outbuildings may be equipped with fattening crates as shown in Fig. 17, or the crates may be set in tiers, as illustrated in Fig. 18. When the crates are placed in tiers, there should be movable boards below each set of crates on which to catch the droppings. These boards should be covered with earth or sawdust. Where so many crates are in use in a building as shown in these illustrations, good sanitation must be maintained or poor results will follow. Where but a single row of crates is used, the droppings may be allowed to fall to the floor, which should be covered with sawdust or loose earth. The positions of the feed troughs are shown at *a*.

57. Throughout certain districts in England, France, Belgium, and other countries where crate fattening is extensively carried on, the crates are kept in the open the greater part of the year. An open-air plant with cramming machines is shown in Fig. 19. Similar plants may be placed in the shade of trees or have temporary shelters from the sun and rain built over them. So long as the weather continues to be fine the fowls will do well in the open, but they should not be left there when the weather is cool or cold. Frequently, shelters made of thatched straw or branches of trees are built over and about the crates. Protection from the rain does not seem to be so much needed as protection from the sun and from winds. A high fence about feeding yards serves as a wind shield. Of course the crates are moved inside the shed in the winter. Though fowls thrive in the open when warm, dry, and well fed, they fatten faster under shelter where it is dark.

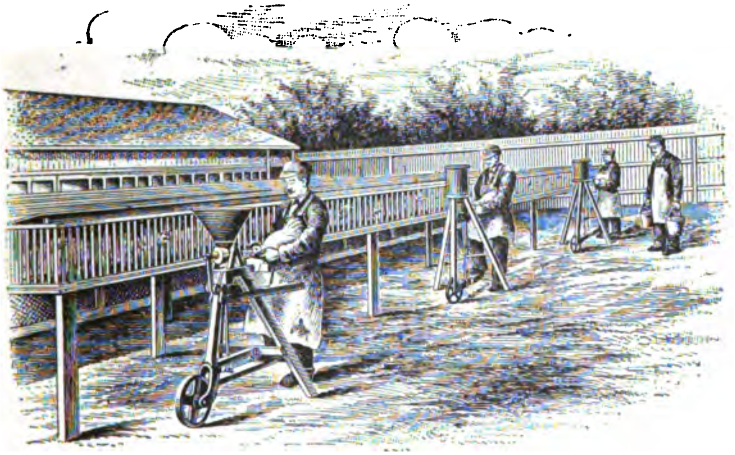

FIG. 19

58. Kinds of Fowls Most Suitable for Crate Fattening. Fowls intended for market poultry should be as carefully bred for this purpose as are fowls for exhibition. There is enough less trouble in the handling of well-bred stock to amply repay the extra cost of its production. Mongrel-bred stock sells for 9 cents a pound in the same market in which well-bred stock sells more readily for 16 cents a pound. It is advantageous in every way to use well-bred fowls for fattening.

Not all fowls will stand the strain of crate fattening. Cockerels that are well bred and that have abundant vitality are best for this purpose, but it will be easier to produce nice, plump market poultry from pullets than from cockerels. Cockerels selected for crate fattening should have considerable length and breadth of body. The back should be broad throughout its entire length; a back that tapers almost to a point at the tail end of the fowl will not finish well. Birds with pointed breast bones and long necks and legs will also fatten slowly. They will lack plumpness and will not sell so readily nor for as high prices as will those that are plump and attractive. Fowls that are heavily built and compact in form turn out best in crate fattening, and those with the greatest width between the thighs and the least prominence of breast bone will carry the largest proportion of breast meat.

59. Well-proportioned cockerels that weigh from 3 to 4 pounds when thin in flesh, should weigh from 5 to 6 pounds when fit for killing. One hundred well-selected cockerels that average 3½ pounds each, or 350 pounds in the lot, before feeding for market, should average 5½ pounds each, or have an aggregate weight of 550 pounds, when ready to kill, a gain of 200 pounds with scarcely any increase in the amount of waste. On the other hand, cockerels unfit for use as market poultry may be fed equally well and because of a lack of a proper body formation they may gain only half as much in weight. For this reason it will be seen that the fowls selected for the purpose of fattening must be of the right size and shape and also be quite vigorous in order to withstand the strain of almost doubling their weight in four weeks or less

60. Methods of Feeding in Crates.—In crate fattening, the methods of feeding most generally followed are: trough feeding, hand stuffing, funnel feeding, and machine cramming. The last three are methods of forced feeding, but machine cramming is the only one of importance to the poultryman who is producing a large number of well-fattened fowls.

61. Trough feeding, or feeding from troughs, is practiced when mash feed of any kind is fed wet to fowls in order to fatten them. This method of feeding is used in house and yard fattening as well as in crate fattening. The position of the troughs on the outside of the crates is shown in Figs. 16 and 18. In trough feeding, the fowls are fed three times, whereas in hand stuffing, funnel feeding, and machine cramming, all three of which are finishing processes, the fowls are fed twice a day.

When first placed in the crates, the fowls should remain without food for a day; then they should be fed in troughs as long as they retain an appetite for the food; after this point is reached, they are usually finished off as later described.

One ration recommended for trough feeding is composed by measure, not by weight, as follows:

Food	Parts
Ground oats	2
Ground barley	1
Ground corn	1

62. All the meals in this ration should be as fine as wheat flour, and all the husks should be sifted out; coarse meals, fiber or husks will not serve for crate feeding. The above ration should be mixed with milk, either sweet or sour, to make as thick a batter as possible. This mash is fed in troughs to the fowls and they are given all they will eat three times a day. No water is given when this semiliquid food is fed. The crates are kept darkened between meals. The fowls are fed in this way as long as they continue to eat freely. In some cases they are killed as soon as they cease to eat well, but the fattening process is generally completed by cramming.

When the fowls in the crates have been fed as above for about 10 days they are usually ready for the forced feeding described later.

63. **Hand stuffing** is very seldom followed at the present time, particularly in America. It consists of pushing boluses or small rounded masses of food into the crops of fowls that are to be quickly fattened. Boluses 1 inch long and about ½ inch thick are moistened with milk and worked into the crop of the fowl by inserting them in the throat or gullet of the fowl and then running the thumb and forefinger down the outside of the throat. This work must be done gently to avoid choking the fowl.

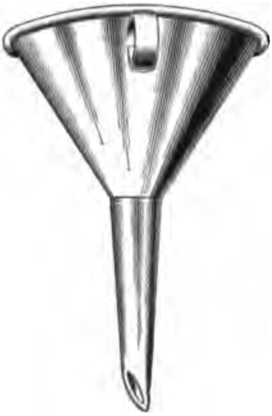

FIG. 20

64. **Funnel feeding** consists in pouring liquid food or gruel of the consistency of thick cream through a funnel into the crop of the fowl. In employing this method of feeding, great care must be taken to avoid choking or otherwise injuring the fowl. Specially made funnels with the ends turned over and so shaped as to lessen this danger may be purchased. A funnel suited for the work is shown in Fig. 20. The funnel is gently pushed down the throat or gullet of the fowl into the mouth of the crop. The different positions of the tip of the funnel as it passes down through the gullet must be followed with the point of the finger on the outside of the neck. After the tip of the funnel has entered the crop, the gruel is poured into the funnel with a spoon. As soon as the crop is full the funnel is removed.

65. **Machine cramming** is the most approved process of finishing fowls for market after they have been partly fattened in crates by trough feeding. It is performed by means of a device known as a **cramming machine.** Machine cramming is for the sole purpose of getting fowls into the

plumpest condition possible for market, after their desire for food has nearly gone, and they eat but sparingly because of the special feeding that they have already undergone.

66. The cramming machine is used to force food into the crop of the fowl. As shown in Fig. 21, it is supplied with a reservoir from which the liquid food used passes into a force pump. In using this machine, the operator places his foot on a treadle or lever and forces it down, thus pulling the pump rod which is attached to a bumper inside the force pump and forcing the food through an outlet into the crop of the fowl. When the pressure of the foot is taken from the treadle the action of the spring is to raise the treadle into place again. By means of a setscrew the mechanism is adjustable to the requirements of the fowl, so that only a certain amount of food can be forced into the crop at any one stroke. This prevents overstuffing.

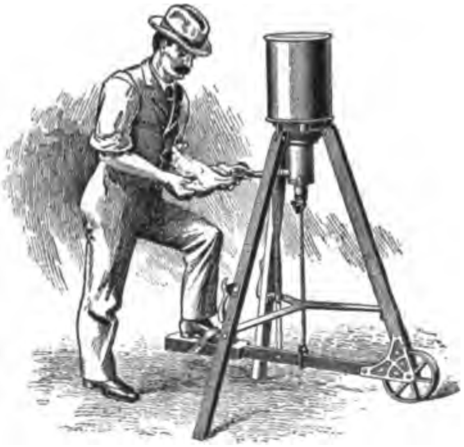

FIG. 21

67. When a fowl is fed from a cramming machine it is held as shown in Fig. 22. The bird's head is held in the operator's left hand, the first two fingers of which guide the feeding tube into the throat of the fowl, and the other two fingers are used to determine the distance to which the tube may go. The fingers of the right hand are placed about the crop so as to tell when it is full. The feeding tube is passed into the throat or gullet below the opening into the lungs, in order to avoid strangulation as the food passes into the crop. When the feeding tube has been adjusted as indicated, a slight pressure of the foot upon the treadle of the machine forces the food through the tube into the crop. This must be done gently, and during the process of feeding the body of the fowl must be held firmly against the body of the attendant to prevent the fowl from struggling. If the fowl is allowed to struggle some accident will most likely occur in the process and the crop of the fowl will be unduly expanded. The tongue of the fowl must be held down against the lower beak and the neck held straight when the feeding tube goes into the throat. The crops of all fowls are not alike in size and shape, and the amount of food best suited to each must be determined by the operator, who must be experienced in order to do the best work. The process of cramming is not painful to the fowl unless the tube is thrust roughly into the gullet, against the root of the tongue, or pushed into the crop, all of which are accidents in operating and not necessarily of frequent occurrence.

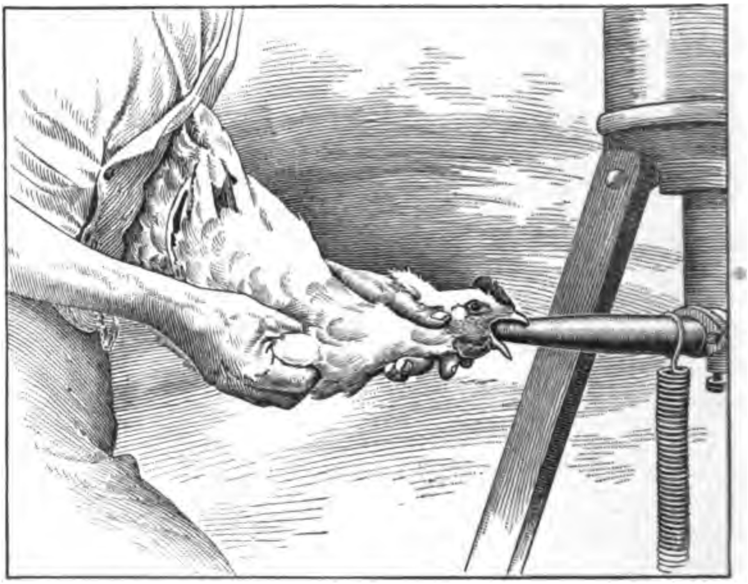

FIG. 22

68. After cramming commences, the fowls should be kept in darkness the greater part of the time. When the cramming process is used, no fowl should be fed as long as any of the previous meal remains in the crop.

The mash fed by means of the cramming machine is the same as that already described as being fed in the troughs, the only difference being that, in the mash prepared for the machine, sweet milk should never be used. Sour milk or buttermilk, the acids of which stimulate digestion and prevent sickness, are strongly advised. Skim milk, if allowed to become sour, can be used. With the use of sour milk no green food is needed. The quality of the flesh will be improved by mixing fresh, sweet, melted tallow with the batter that is fed

TABLE I
FATTENING RATIONS

Food	Parts	Food	Parts
(*a*)		(*b*)	
Ground oats........	1	Ground oats........	4
Ground barley	1	Ground peas	1
Ground corn........	2	Ground corn........	4
(*c*)		(*d*)	
Ground oats........	2	Ground corn........	2
Ground corn........	2	Ground buckwheat .	2
Clover meal.........	1	Ground oats........	1
Blood meal.........	1		
(*e*)		(*f*)	
Ground oats........	4	Ground oats........	5
Ground barley	1	Ground barley......	1
Ground buckwheat ..	1	1 ounce of tallow to each 4 birds......	

during the last week of fattening. The tallow is used in this way only in machine cramming, and not more than 1 ounce should be given to four fowls in any one day. The batter fed through the machine must be more liquid than the batter fed in the troughs.

69. Fattening Rations.—The rations best suited for feeding by the cramming machine, but which may also be used in other methods of crate feeding, are given in Table I. All the meals used should be ground as fine as wheat flour; coarse meals, fiber, or husks will not answer for any form of crate feeding. The rations (*a*), (*b*), (*c*), and (*d*) are all suited for use when yellow-meated fowls are desired; mixture (*e*) will produce white-meated fowls, and mixture (*f*) is for use in the cramming machine during the last week of feeding. The formula best suited for any given locality should be selected and used. In general, fattening rations for poultry should have a nutritive ratio of from 1 to 4 or more. In all cases the parts in Table I are calculated by measurement and not by weight.

MARKET POULTRY

(PART 3)

PREPARATION OF POULTRY FOR MARKET

KILLING OF POULTRY

1. Treatment of Fowls Preparatory to Killing.—Fowls should have no food for 24 hours preceding the time when they are to be killed for market, but should have all the pure, fresh water they will drink. When a fowl is killed while its crop and intestines are filled with food, decomposition sets in immediately. If it is given no food for a day but has plenty of water, the crop and intestines will be flushed out fairly clean, and the carcass will remain fresh for a considerable time provided it is kept in a cool place and away from the influence of bad odors. The idea that a full crop will add to the profit derived from the fowl is misleading; a small amount will be added to the weight, but the price per pound will be somewhat less, if offered for sale in the wholesale market. Sometimes private buyers are not so discriminating about this point.

During the 24 hours preceding killing, fowls should not be disturbed or excited. Under no circumstances should a fowl be chased just before it is killed until it becomes exhausted or even until it becomes overheated. This is an important matter, because overheating the flesh in this way will toughen it and make it less palatable.

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2. Indication of Fitness of Fowls for Killing.—One of the most trustworthy methods of determining when a fowl is fit to be killed is by feeling the cartilaginous, or gristly, projections that grow out from both sides of the backbone at about the middle of the back and extend down toward the vent. If these cartilaginous projections are covered with flesh so as to be difficult to locate, the fowl is ready to be killed; if these projections can be felt readily, the fowl is unfit for killing.

A full knowledge of how to tell at a glance when a fowl is fit for killing can only be obtained by experience in fattening poultry for market. It is very important, however, that the beginner in the business accustom himself to picking out those fowls that are fit to kill as soon as they reach this stage. By killing off fowls as soon as they are ready for the knife, the expense for feed and labor will be lessened; there is no profit in feeding a fowl after it has reached the point where it is ripe for killing.

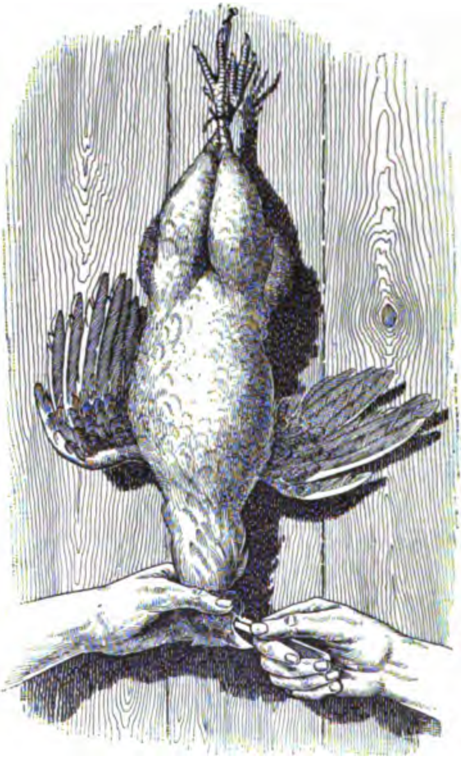


Fig. 1

3. Methods of Holding and Swinging Fowls for Killing. Where the killing of fowls is done on a considerable scale, several methods of holding and swinging them are in use. A common way of holding is to fasten the legs of the fowl to a flat board placed across the knees of the operator, who holds the head with the left hand, and cuts with the right hand in any of the ways that are described later.

4. The killing is more quickly accomplished, however, if the fowl is hung up by the shanks. There are several ways of doing this, each of which is favored by different operators. One way of swinging, or suspending, a fowl for killing is to place its feet in the loop of a rope and hang it against a wall as shown in Fig. 1. When suspended against a wall in this way, there can be but little movement of the body. The height at which the bird is hung is regulated by the height of the operator.

5. Another way of swinging a fowl is by means of a **spreader,** or **widener,** which is shown in Fig. 2. This is made of iron, but one that will serve the purpose equally well may be constructed of wood. The spreader shown is 18 inches long from the point *a* to the point *b* and is made so that it can be turned on the rod *d*. The rod, which is made of ½-inch round iron, has the upper end turned into a hook so that the spreader can be hung up. The shanks of the fowl are placed in the notches of the spreader, and when suspended in this way the bird cannot struggle to any great extent. The long arm of the spreader is for the larger fowls, and the short arm *c* makes a convenient length for the smaller fowls.

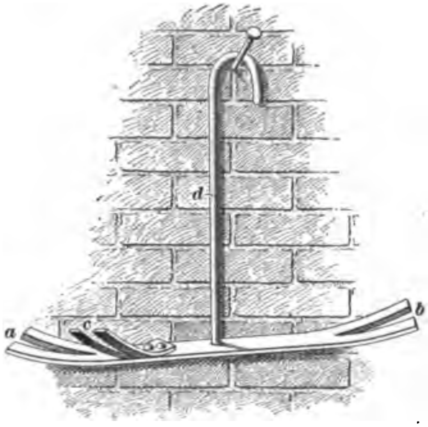


FIG. 2

A fowl suspended in a doorway by a spreader is shown in Fig. 3. It is believed by some that the use of the spreader assists in forcing the blood to drain more rapidly from the body, but there is no absolute proof that such is the case.

6. A receptacle for catching the blood should be placed under the fowl that is being stuck through the mouth or the neck. A tin can weighted with small stones and fastened to the lower beak by a wire hook is sometimes used for this purpose, as shown in Figs. 8 and 9. The weight holds the head of the fowl down and helps to prevent body motion. This hanging of a weight from the beak of a fowl is advocated by some and condemned by others, who claim it is in the way.

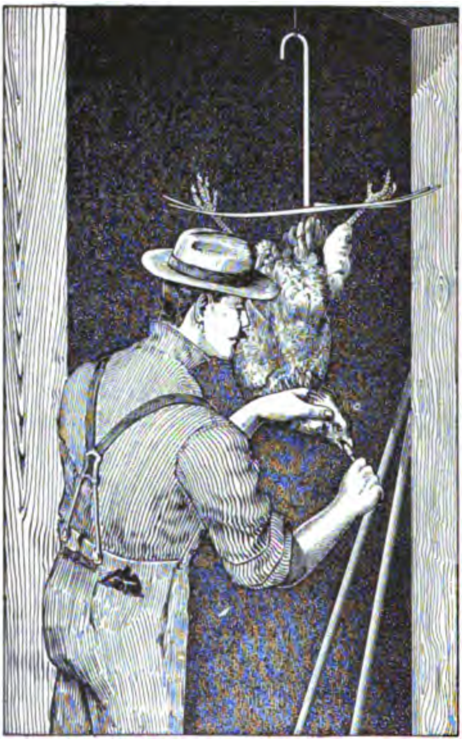


FIG. 3

7. Influence of Method of Killing on Plucking and Flavor. The manner in which the killing of a fowl is done has much to do with the ease or the difficulty of plucking the feathers, and also has a decided influence on the flavor of the flesh. If the method is such that the fowl is not paralyzed and killed the instant it begins to bleed, the muscular contractions that ensue cause the tissues to become tense. This makes the flesh hard and stringy, and the feathers cannot be pulled out without considerable effort. In such cases, scalding of the carcass will usually be necessary in order to allow the feathers to be removed. On the other hand, fowls that are properly killed are completely paralyzed simultaneously with the starting of the bleeding and hence the tissues are left in a relaxed condition. In this condition the feathers can be removed by dry plucking, or plucking without scalding, if the plucking is done before the carcass loses its body heat.

The point to bear in mind is that the sticking should not be done as if it were only for the purpose of bleeding the fowl; the severing of the jugular vein and other blood vessels and the paralyzing of the brain should be performed as nearly simultaneously as possible. When the sticking is skilfully done so as quickly to cause paralysis, the blood will flow freely, there will be no violent contractions of the muscles, the flesh will retain its quality, and the feathers will loosen so they can be plucked with ease. The reverse of these consequences is caused by doing the sticking in a blundering way.

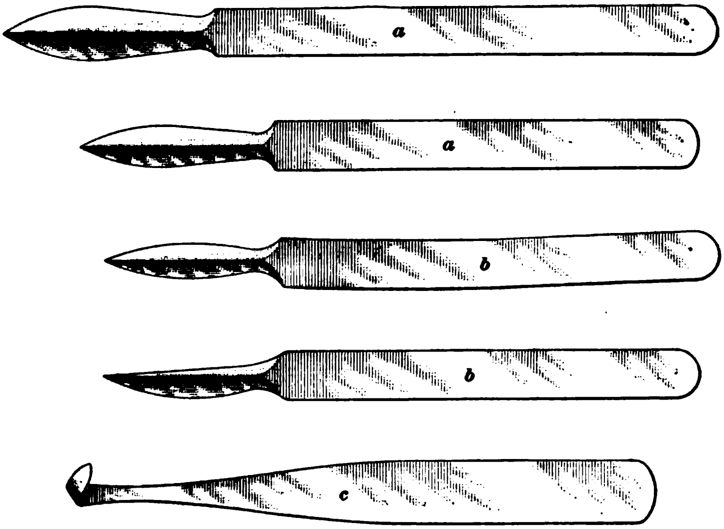


FIG. 4

8. Knives for Killing.—The only instrument required for killing fowls on a commercial scale is a sharp-pointed knife of some kind. Knives made especially for killing are shown in Fig. 4. The larger knives *a* are used for killing full-grown fowls; the smaller knives *b* are used for killing broilers and squabs; some poultrymen, however, prefer a large or a small angular knife like the one shown at *c*. A pocket knife may be used if nothing better is at hand; the blade must be kept sharp, however, so that the veins can be readily severed, and it must be long enough to reach the brain so as to puncture it.

METHODS OF KILLING

9. There are several methods in common use for killing fowls on a small scale. These are: (1) Wringing the neck; (2) severing the blood vessels in the top of the head and then hitting the fowl on the top of the head to make it insensible; and (3) severing the head from the neck.

The first is the most painful of all the methods, and is a bungling way in which to kill a fowl. The second method is also a bungling one, and is only a little less painful than the first. The third method, that of severing the head from the neck, is the most humane of these three methods. This should be done at a single stroke with a sharp ax or hatchet or a heavy knife. A dull instrument causes great pain to the fowl.

When the head of a fowl is severed from the neck by a knife it is customary to hang the bird inside a barrel, in order to keep the operator from becoming splashed with blood. The knife must be sharp in order to be capable of cleanly severing the head from the neck at a single stroke. If this method of killing is followed the bird can be left hanging inside the barrel until all the blood is drained out.

These methods are all violent, and when a fowl is killed in any of these ways the carcass must be scalded before it is plucked.

10. The methods of killing poultry for market on a large scale that are most generally practiced are: *Sticking through the roof of the mouth, sticking through the neck*, and *dislocating the head.*

11. Sticking Through the Roof of the Mouth.—The method most used for killing fowls in commercial poultry establishments is by **sticking through the roof of the mouth;** this method is also sometimes called bleeding through the roof of the mouth. When properly done, the jugular vein and the other blood vessels in the roof of the mouth are cut and the brain is pierced practically simultaneously, and all of the blood will drain readily from the carcass, because the fowl is completely paralyzed as soon as the bleeding commences. Fowls killed in this way will keep in good condition for a longer time when exposed for sale than if killed in any other way.

12. The first step in killing, after the fowl has been swung, is to take hold of its head with the left hand and hold it firmly to prevent struggling; the head is then drawn down and the mouth opened with one finger, when the blade of the knife is inserted with the right hand into the mouth until the point reaches just back of the ears of the fowl. The large blood vessels on each side of the throat are first cut, and when this is done properly the blood will flow freely. The blade of the knife is then turned up toward the front of the mouth and the point thrust into the brain through the roof of the mouth just above the eyes or on a level with them. When the brain has been pierced the blade is given a twist to make sure that the paralysis will be complete. As the brain is pierced by the point of the blade there will be a nervous twitch of the body, the wings will flop, and the entire body plumage will loosen. The fowl is then dead, although the muscles may contract or the wings flutter for a few minutes, and the dry plucking should commence at once before the carcass becomes cold. The weight, if one is used, is fastened to the lower end of the beak when the knife is withdrawn from the mouth. Some operators hold the head of the fowl so that the stroke of the knife will be made away from themselves, while others prefer to cut toward themselves.

13. If the fowl is killed on a board instead of being swung, its legs should be fastened tightly to the board with a cord. The head is grasped and the cutting done in the same way as when the fowl is swung.

14. The entire process of killing by sticking through the roof of the mouth takes much less time than to tell about it. In fact, a fowl can be swung, stuck, and killed in less than a minute. When considerable killing is done, the fowls should be in coops close at hand, and several persons should work together, some to kill and rough-pick the birds and others to pinfeather and complete the dressing.

15. Sticking Through the Neck.—In killing fowls by **sticking through the neck,** the arteries and veins in the back of the neck are severed. In this method the fowl is swung or held in the same manner as if it were to be stuck in the mouth. It is then stunned by a quick, sharp blow on the head with a club. The operator immediately presses the fowl against his body with his left forearm in such a manner that the wings are prevented from flapping, and the head of the fowl is turned sidewise in the left hand so that the ear may be plainly seen. The fowl is then stuck by passing a knife completely through its neck just back of the ears. The knife should have a sharp point and a sharp edge, and its blade should not be more than ½ inch in width. In sticking the fowl, the knife should be turned and twisted until the blood flows freely. Just as soon as the knife is withdrawn, the wings of the fowl should be grasped in the left hand and the feathers removed with the right.

When the operation is well performed, fowls bleed quite as freely from the neck as from the mouth. After some practice, fowls can be killed by sticking through the neck more quickly and easily than by sticking in the roof of the mouth. For these reasons sticking through the neck is recommended in the killing of market poultry that is to be sold with the heads removed.

16. Dislocating the Head.—The method of killing fowls by **dislocating the head** is the easiest to learn, and the knack of doing it may be easily acquired by women and half-grown children after a little practice. This method of killing fowls should be more generally practiced in all parts of the world.

It is a bloodless operation and is perhaps the best way to kill fowls that are to be cooked within a short time after killing.

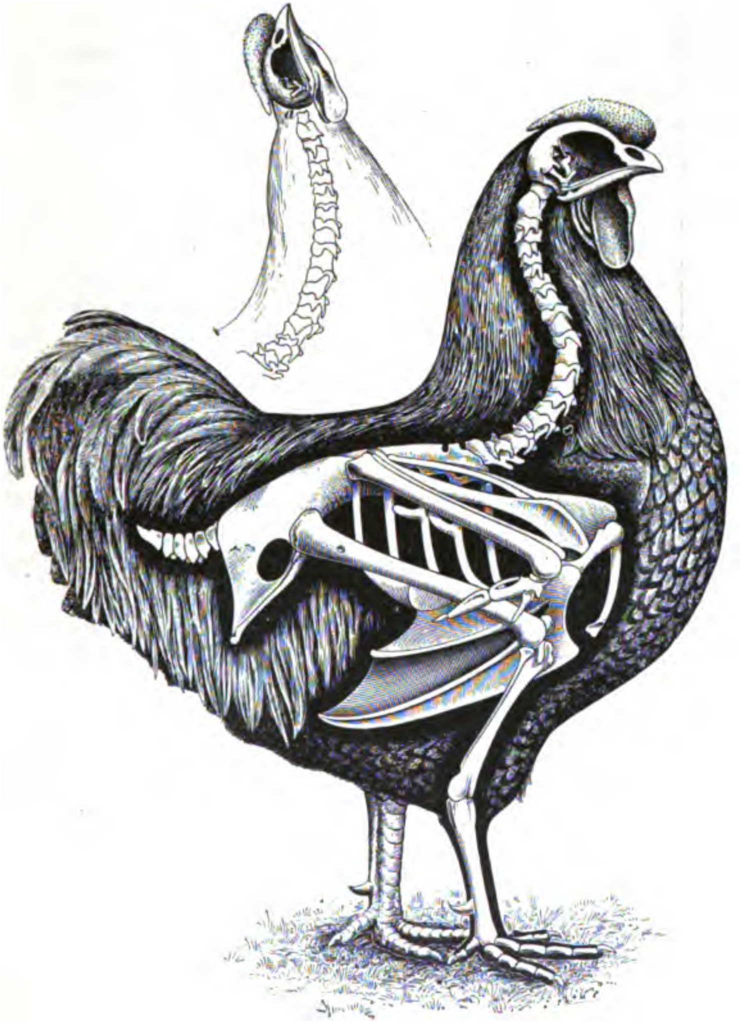


Fig. 5

17. Fowls may be killed very quickly and painlessly by dislocating the head from the bones of the neck. When this is done and the neck is stretched, the veins of the neck are ruptured; the blood flows freely from the body of the fowl and settles in the opening made inside the neck. The formation of the neck bones and their connection with the head are shown in Fig. 5. If the head is bent backwards its connection with the neck is severely strained, and if the head is held firmly in this position it can be readily dislocated as shown at *a*.

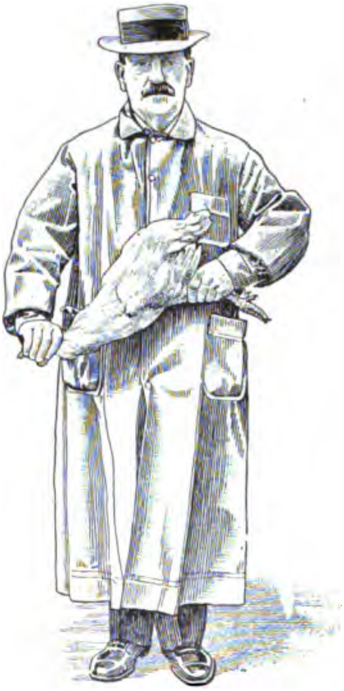


Fig. 6

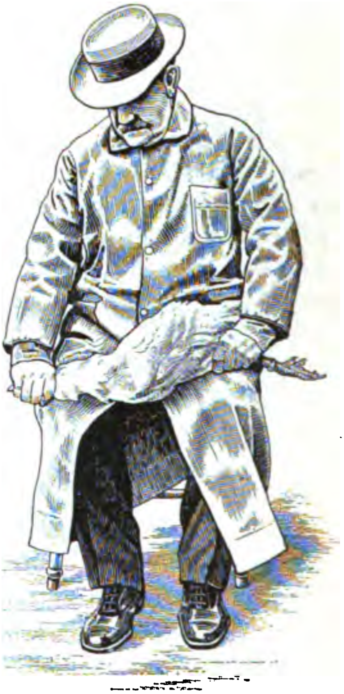


Fig. 7

18. The head of the fowl may be dislocated while the operator is either standing or sitting. To perform the operation while standing, the operator grasps the fowl firmly in the left hand, holding its side against his body, and its head close to his right thigh, as shown in Fig. 6. The operator should grasp the head in the right hand with the thumb pressing against the back of the head. He should bend the head back as far as possible, disjointing it, and stretching the neck so as to have the head and the bones of the neck about 1 inch apart. A tight hold should be kept on the feet of the fowl, the wings should be free, and the fowl's head should be kept down so as to allow the blood to drain from the body into the cavity of the neck. Care should be taken to avoid breaking the skin when the neck is stretched.

19. When the operator is seated, the fowl should be grasped as shown in Fig. 7, with the legs and the wings held in the left hand and the neck held in the right hand. The left hand of the operator should rest on his left knee, and the right hand on his right knee. The head of the fowl should be bent back with the ends of the fingers, and the operator's knees should be forced apart so as to dislocate the head. The head is then permitted to hang downwards so that the blood can drain into the cavity that has been formed in the neck.

DRESSING OF POULTRY

REMOVING THE FEATHERS

20. Methods of Plucking.—The process of removing the feathers from the carcasses of fowls is commonly called **plucking,** though by some poultrymen it is termed **picking.** There are two ways of plucking fowls: *dry plucking* and *plucking after scalding.*

21. Dry plucking is possible only when fowls are killed in such a way that the tissues of the skin are left in a relaxed condition and thus offer but little resistance to the removal of the feathers. The dry plucking, however, must be done immediately after the fowl has been killed and before the body heat has left the carcass. Dry plucking requires less labor than plucking after scalding and insures a far better finished product.

Figs. 8 and 9 illustrate the way in which dry plucking is begun when a fowl has been hung up by the feet, either by means of a cord or a spreader. A basket, barrel, or other receptacle is placed in a convenient position so that the salable feathers can be thrown into it. As explained in describing killing methods, when the knife punctures the brain, paralysis ensues, the tissues of the skin as well as those of the flesh become relaxed, the fowl dies immediately, and dry plucking is commenced at once. The weighted can for catching the blood, if used as shown in the illustrations, is attached immediately the knife has been withdrawn.

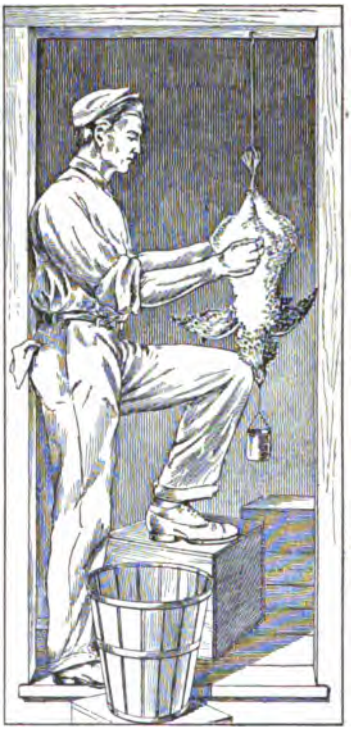


FIG. 8

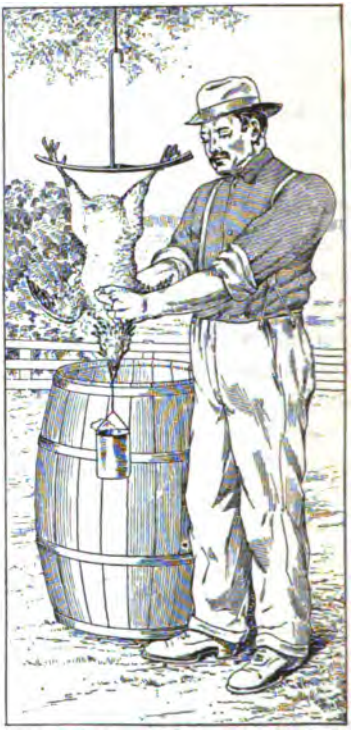


FIG. 9

22. **Plucking after scalding** is practiced extensively throughout the rural districts where the greater portion of all

poultry is killed by severing the head with a hatchet. Plucking after scalding is made necessary by the crude methods of killing employed. Plucking after scalding is thus the method of plucking fowls most widely used, in spite of the poor results it gives, and the fact that it need be used only when fowls are killed in such a way that the tissues of the skin are not left in a relaxed condition or when the carcass is allowed to become cold before it is plucked. In either of these cases it is necessary to scald the skin in order to relax the tissues so that the feathers can be plucked without an undue tearing of the skin.

Scalded fowls are plucked in the same way that unscalded fowls are plucked. Their feathers will come off much more easily than in the method of dry plucking; in fact, their feathers will come off by handfuls, and in some instances can be rubbed off by the fingers. Scalded fowls, if they are to bring good prices, must be cleaned of pinfeathers and singed just as thoroughly as dry-plucked fowls. They should not be plucked in a cool or cold atmosphere, as the cooling that results under such conditions will be sufficient to contract and wrinkle the skin of the fowl and thus further injure its appearance.

Scalded poultry will not keep so well in cold storage as dry-plucked poultry, and hence is not usually selected for cold-storage purposes unless it is particularly well prepared for market.

23. Dry-plucked fowls always present a more attractive appearance than those that have been plucked after scalding. Scalding injures the appearance of the skin to some extent, no matter how skilfully it may be done. In fact, even birds of poor quality if properly dry-plucked will often appear to better advantage than birds of a better quality that have been scalded.

The appearance of scalded fowls is shown in Fig. 10 and that of dry-plucked birds in Fig. 11. The skin of the fowl on the left in Fig. 10 is badly injured because of overscalding, or cooking, and subsequent breaking when the plucking was done; the skin of the fowl on the right is not badly injured, but still is not attractive. Originally, all four of the birds shown in Figs. 10 and 11 were of the same quality, and both pairs were killed and picked by the same expert. From evidence of this kind it is plain that it is almost impossible to obtain as good an appearance with poultry that has been scalded, as it is possible to secure with dry plucking after a little practice. Sometimes, however, it will be found necessary to scald a fowl even when dry plucking is systematically practiced, because of some accident in killing.

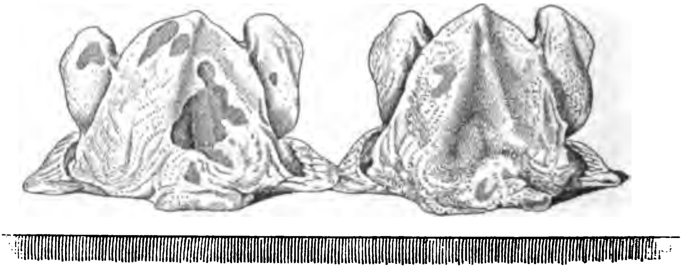


FIG. 10

24. Scalding of Fowls.—Some injury to the appearance of a fowl always results from scalding, but an expert can do much to reduce the extent of the injury if he knows how to scald in order to get the best results. In plucking after scalding, the greatest loss is caused by overscalding, or cooking the skin of the fowls. When the skin of a fowl is cooked to any extent it is easily broken while the fowl is being

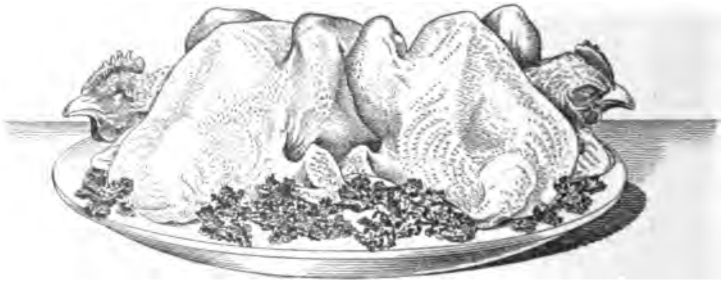


FIG. 11

plucked, dark places appear on the carcass, the flesh protrudes through the skin, and the meat of the fowl will be dry and less palatable than where cooking has been avoided.

25. In scalding a fowl, the feet are held in one hand, the head in the other, and the body immersed as shown in Fig. 12. Boiling water must be used for scalding, as the heat must be applied suddenly, but only for a few moments. In dipping a fowl into scalding water, the entire body, with the exception of the head and feet and such portion of the neck on which the feathers are to remain, is immersed, and the dipping is repeated several times if necessary. The exact length of time to hold a fowl in hot water is a matter of judgment, which can be gained only by actual experience in dipping poultry. More care should be taken in dipping young fowls than in dipping older birds, as the skin of young fowls will scald or cook much sooner than the skin of more mature fowls. Plunging the body of the fowl into cold water immediately after it is taken from the hot water will materially lessen the danger of cooking the skin to a harmful extent.

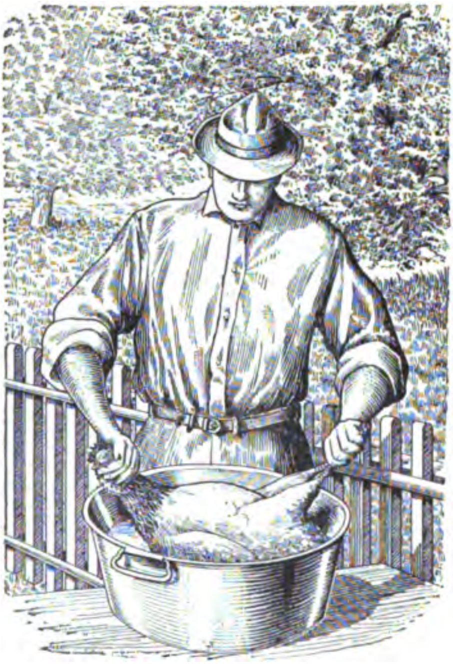


FIG. 12

26. Style of Plucking.—The style of plucking, or the quantity of plumage left on the carcass of a fowl, depends mainly on two things: the demands of the market in which

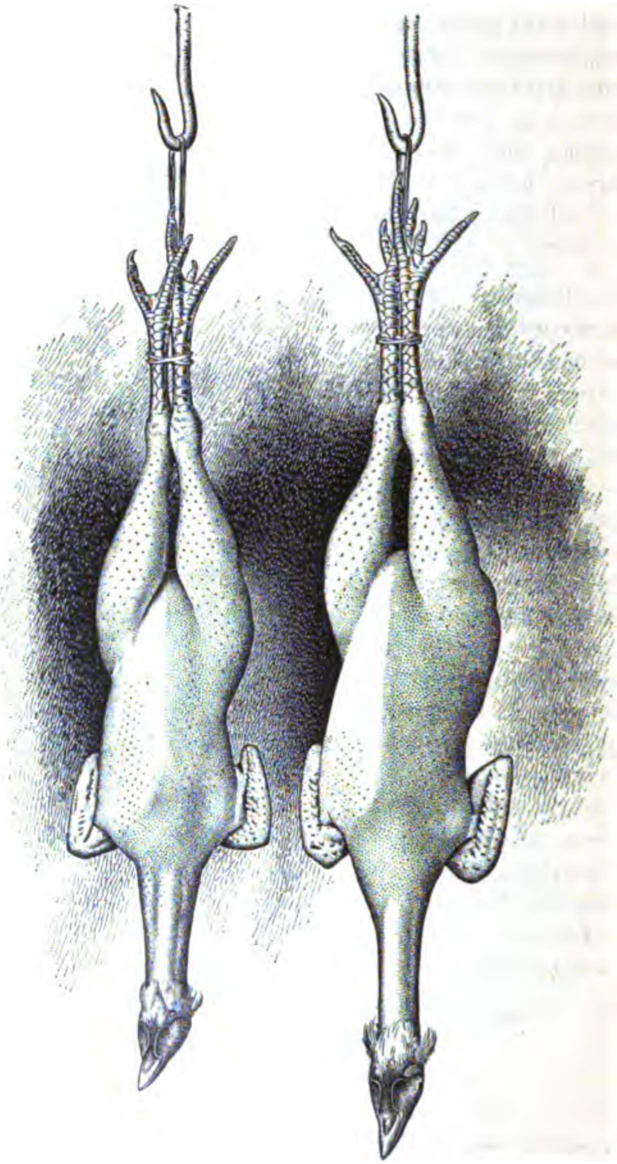
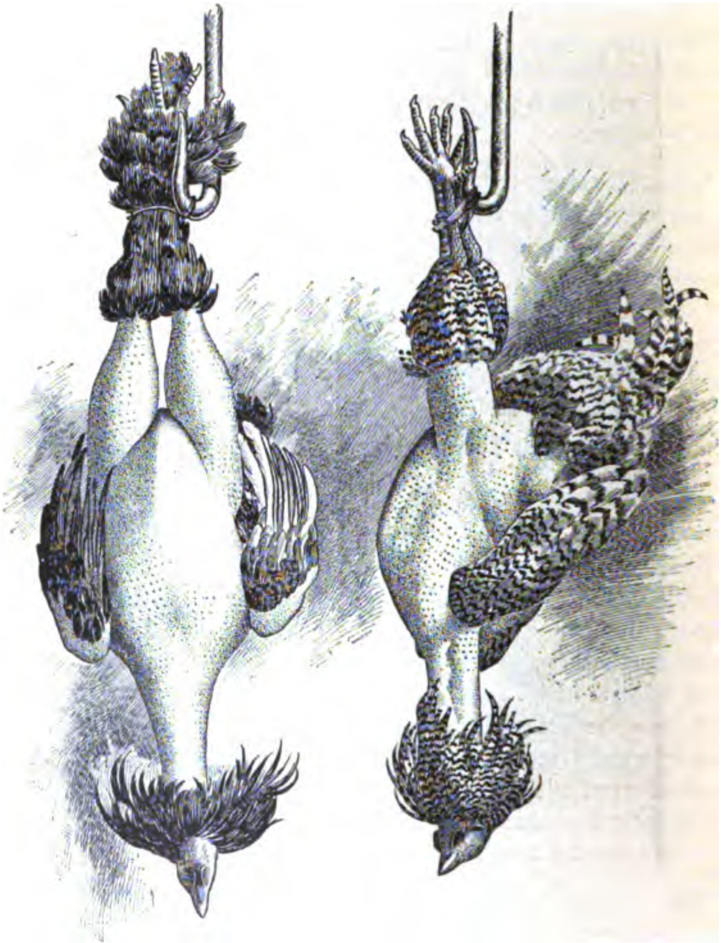


FIG. 13

the bird is to be sold, and the class of market poultry to which the bird belongs. It is usually an advantage in most markets to offer well-bred poultry for sale with at least some of the feathers about the head and hock joints as marks of quality. Sometimes these feathers are left on all classes of market poultry to indicate to the purchaser the color of the plumage of the fowl; this is particularly true when the plumage happens to be white.

27. Roasters, for instance, are plucked in several different ways, according to the demands of the market in which they are to be sold. It will sometimes happen that clean-plucked roasters will sell in city markets at higher prices than capons or other roasters that have part of the plumage left on their bodies. Such prices are, of course, based entirely on the size and quality of the fowl in question. But, as a general rule, roasters are put on the market with the feathers left on one or more parts, in order to cater to the fashion that prevails in the market for which they are intended. Sometimes the feathers are left on the head and neck only; at other times they are left on the head, neck, and around the hocks, or perhaps a few of the flight feathers may be left on the wings. In the case of capons, when sold as capons, the feathers are always left on the head, neck, legs, wings, and tail. The extremes in the style of plucking are shown in Figs. 13 and 14. The birds in Fig. 13 are clean-plucked roasters; that on the left is a medium-weight roaster and that on the right is a heavy-weight roaster. The breasts of both are plump and well covered with meat. The capon shown in Fig. 14 (*a*) is an Asiatic and that shown in (*b*) is a Plymouth Rock. Both are well formed and of a good quality for profit.

28. Fewer feathers are left on the legs of capons that have an excess of feathers on their shanks and toes than are left on those that have smooth shanks and toes. As capons sell at the highest prices only from February to April, and after April soft roasters sell better than capons, it is very often the custom to pluck all the feathers from the carcasses of capons that are to be sold at that time and to sell them as soft roasters. Any fowl that has firm yet tender flesh may be termed a soft roaster, and as capons meet this requirement they sell readily during this time as heavy-weight soft roasters.



(a) (b)

Fig. 14

29. Broilers are usually sent to market with all their feathers plucked off. They must be absolutely clean of all pinfeathers and down. Fig. 15 shows at the left a live broiler and at the right the same bird after it had been killed, plucked, and made ready to be sent to market. This illustration also points out clearly that the quality of fowls can be determined from an inspection before they are killed.

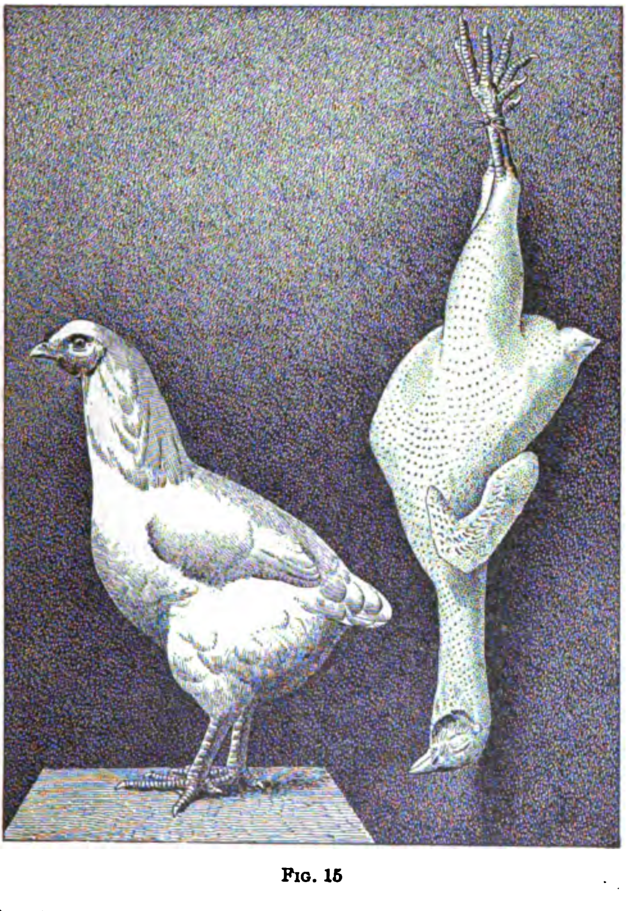


FIG. 15

30. Manner of Plucking Feathers.—In plucking fowls, the feathers should be drawn out of the skin in the direction opposite to that in which they lie naturally. Thus, if the fowl is hanging head down, the feathers are pulled down toward the head. Feathers should always be removed in this way.

When first learning to pluck, the beginner should take only a few feathers between the thumb and fingers of the right hand, though after the picker becomes more proficient a considerable number of feathers may be grasped and extracted at one stroke. After the feathers are grasped, turn them out and back from their natural position and pull down on them in the direction of the head of the fowl with a slight twist and jerk. This will bring them out of the skin in the best possible way. Repeat this action rapidly until all the feathers are removed. At first there is some danger of tearing the skin, but proficiency in plucking is soon acquired and it is not long before the beginner is able to pluck fowl after fowl without making a single break in the skin. The danger of tearing the skin is less with old fowls than with broilers.

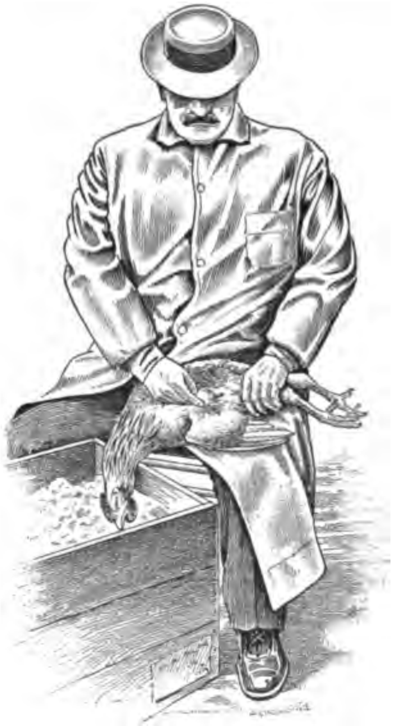


Fig. 16

31. Directly after the feathers are plucked, all pinfeathers and long hairs should be removed from the plucked surface, so as to leave the carcass perfectly clean and smooth. The pinfeathers can be removed either with the thumb and finger or with the blade of a knife held against the thumb. The hairs are usually removed by singeing. It is best to use the flame of a spirit lamp for singeing. Straw or paper are often used for this purpose, but their use cannot be recommended, as either is apt to scorch or leave a taint of smoke upon the skin of the fowl. In some markets there is an aversion to the appearance of poultry that has been scorched in singeing.

32. In plucking fowls the operator either sits or stands. There is some prejudice against the sitting position, because it is more tiresome to work this way; still, it is often followed in poultry establishments where large numbers of birds are dressed. In plucking while sitting, the plucker should grasp the fowl's legs firmly in the left hand, and hold the fowl with its head away from him as shown in Fig. 16. Some operators start plucking with the crop and breast feathers and go in regular order to the feathers of the thighs, back, tail, and wings; others begin with the tail and wing feathers and then pluck the body feathers. If the plucker is a rapid worker it

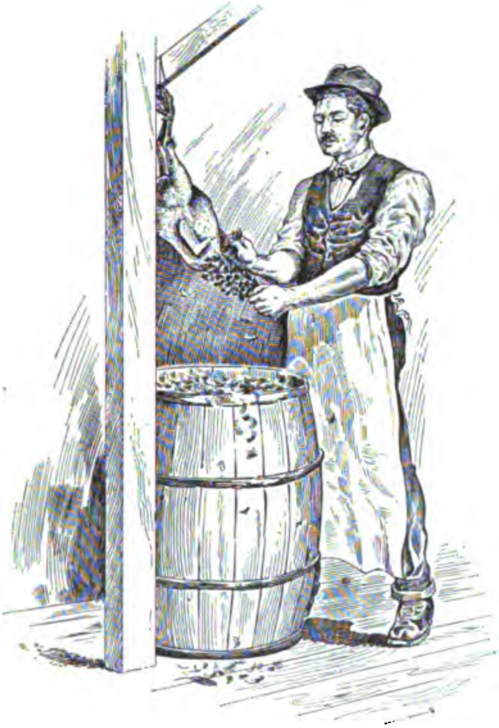


FIG. 17

makes little difference at which part of the fowl he commences to pluck, but if he is inclined to be at all slow it is better for him to start with the crop and breast feathers and work out toward the tail and wing feathers, for in this way he will remove the feathers from the most tender and conspicuous parts of the fowl before the tissues of the skin of these parts have time to become tense; he will thus be likely to do the work better and quicker.

33. Many expert pluckers prefer to pluck while standing as they claim that in this position they can make better time. When this position is taken, the plucker stands in front of the fowl as shown in Fig. 17. One hand is used to steady the fowl and the other to pluck the feathers. These are usually removed in the following order: From wings, tail, back, thighs, breast, and crop. Those who have become expert in this method of plucking do the work with wonderful swiftness, and can usually pluck from five to seven fowls in an hour. They usually remove all the feathers except those about the head and neck.

34. Handling After Plucking.—A carcass of a fowl should never be left hanging for any length of time after the plucking has been completed. If the carcass is allowed to hang for even a short time, the body, being still warm, will soon become stretched and thin looking, and hence lacking in plumpness no matter how well fattened it may have been. If the carcass is once allowed to cool and set while drawn out at full length there will be little chance of being able to restore it again to an appearance of plumpness. Hence as soon as a carcass has been plucked it should be taken down, molded a little with the hands so as to force it into a trifle more rounded condition, and laid down on a flat surface until the poultryman is ready to proceed with its preparation for market.

SHAPING THE CARCASS

35. Object of Shaping.—The object of shaping the carcass of a fowl is to change its shape by some device so as to improve its appearance. There are two methods of shaping: shaping with a cloth and shaping with a shaping board. If either of these methods is properly carried out, the result will be to make the fowl appear more plump by removing such angles as are, for instance, formed by a too prominent breast bone; and if the same method of shaping is systematically practiced in any particular poultry establishment, it will result in giving its product a uniform and distinctive appearance. Not only poor but also the best grades of market poultry have their appearance improved by shaping, and in fact the greatest profit will come from shaping the best grades.

36. When shaped artificially, the carcass of a fowl will have an attractiveness that cannot be obtained by any method of fattening. The whole carcass appears plump, no matter from what side or end it is viewed, and no sharp angles due to bones not being covered with flesh are exposed, nor do lumps of fat protrude.

In European countries particular attention is given to the shaping of the carcasses of poultry that is sent to market, but in America very little has been done up to the present time along this line. However, this detail in the dressing of fowls would undoubtedly be as profitable in America as it is in Europe, and offers a promising opportunity for the improvement of certain grades of market poultry by those American poultrymen who cater to a high-class trade.

37. Shaping With a Cloth.—The method of improving the carcasses of fowls by shaping with a cloth is practiced almost exclusively in France, and even in that country it is not practiced very extensively at the present time. This is in spite of the fact that excellent results are obtained by this method, the objection being that it is tedious and costly because of the large amount of hand labor it entails.

The chief object of this particular kind of shaping is to elongate the carcass and make it somewhat conical in form, with the broad end of the partial cone at the tail and the small end at the neck; an incidental object of this method is to whiten the skin and flesh of the fowl when milk is used in the process. The success of the method depends on the amount of pressure that is exerted by the drying out and shrinking of the canvas that is used.

38. The details of the method are as follows: The body of the fowl is first wrapped in a clean linen cloth that has been moistened in milk or water, care being taken to have as few wrinkles as possible in the cloth. Then a piece of canvas that has been moistened in the same liquid as the linen cloth is drawn over the cloth. This piece of canvas is wider at one end than at the other, and when it is tightly fastened about the carcass the pressure from the shrinking of the moistened canvas forces the body of the fowl into the desired shape. The canvas is fastened either by drawing it tightly with the fingers and sewing it securely, or by pulling strings tightly through eyelets made in the canvas so that it will be in the proper position when it shrinks to force the carcass into the required shape. The carcass is left encased in the canvas and linen cloth for about 24 hours, by which time the canvas and the cloth should dry out and the body of the fowl be squeezed into the desired shape.

39. Though the linen cloth and the canvas may be moistened with water if milk is not available, milk is to be preferred as it not only softens but whitens and flavors the skin of the fowl. Besides shaping the carcass, the canvas causes an imprint of the weave of the linen cloth to be left in the moistened skin of the fowl. This stamps the fowl as unmistakably shaped with a cloth, and in some markets causes it to sell for a higher price. The flesh and skin of La Bresse fowls, which are remarkable for their whiteness, are made even more attractive by the process of shaping with a cloth moistened with milk, as the pressure exerted by the shrinking of the wet canvas squeezes all the blood from the skin and the greater part of the blood from the flesh, thus adding to the whiteness imparted to the skin and the flesh by the milk.

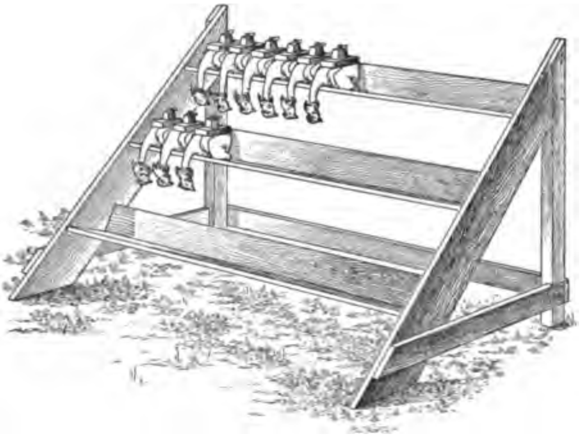


FIG. 18

40. Shaping With a Shaping Board.—The greater part of all fowls sold in Europe are forced into shape by simply being pressed while warm in V-shaped shaping troughs made of boards. The style of trough shown in Fig. 18 is popular, and is extensively used for shaping the famous Surrey and Sussex fowls. A cross-section of one of the troughs and the manner

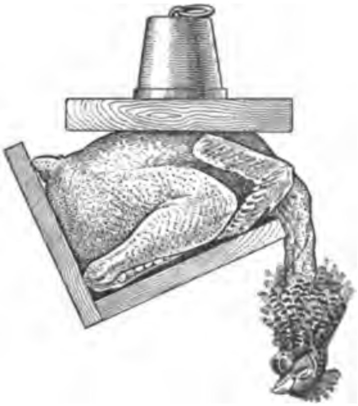


FIG. 19

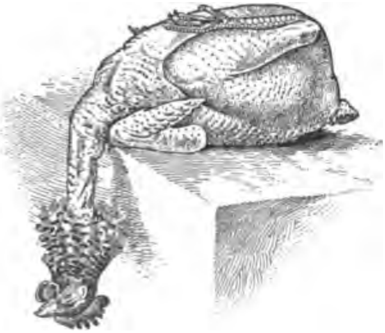


FIG. 20

of using it are illustrated in Fig. 19. The bottom board, which slopes up, is wider than the board at the rear, which slopes back. When the carcass is placed in the trough a board is placed on the back of the fowl and on top of this is placed a heavy weight as shown. This forces the carcass down and holds it firmly in the mold. A specimen of board-shaped poultry is shown in Fig. 20.

DRAWING, TRIMMING, AND TRUSSING

41. The final steps in the preparation of the finest grades of market poultry are known as *drawing*, *trimming*, and *trussing*. **Drawing** is disemboweling the bird, or removing its entrails. **Trimming** is removing the head, part of the neck, the feet, part or all of the shanks, and the sinews, or tendons, of the legs. **Trussing** is fastening the wings and legs of the bird with skewers or tying them with cord, so that the carcass will present the best possible appearance for market.

Strictly speaking, the terms drawing, trimming, and trussing should be used as defined above, when applied to market poultry. There is, however, some ambiguity in the common usage of the term trussing, for this term, as used by those who prepare the best grades of poultry for market, often includes drawing and trimming. This is due to the fact that a fowl is not ordinarily trussed until after it has been drawn and trimmed, and the mention of the last step in the process of preparing fowls for market in this way implies the completion of the other two steps. Thus, a trussed fowl as it is put on the market commonly has the entrails, the head, part of the neck, the feet, part or all of the shanks, and the tendons of the legs removed, in addition to having the wings and legs bound securely so that the body is rounded into an attractive shape.

42. Fowls may be drawn, trimmed, and trussed most quickly, immediately after they have been plucked and while the body is still warm, if necessary; but the work can be done much more satisfactorily when the flesh has become cool and firm. A carcass that has been kept overnight on a shaping board in a cool atmosphere will be in the most satisfactory condition for these operations. This practice is largely followed in European countries and is gradually finding favor in other lands.

The plucked carcass, including head, feet, and entrails, is weighed before it is drawn, trimmed, and trussed, and its selling price is based on this weight, plus a charge of from 15 to 25 cents for the work.

Those familiar with the work can kill, pluck, draw, trim, and truss a fowl in from 10 to 12 minutes.

43. Drawing of Poultry.—The market demands in different sections give rise to two grades of drawn poultry; in one grade only the intestines are removed, and in the other all of the entrails are taken out. Naturally, the latter grade is the better of the two.

44. The operation of removing only the intestines from the body of a fowl is comparatively simple if the legs are held back out of the way. While this is done an incision is made crosswise of the fowl's back just above the vent; in making this cut, which should be just large enough to admit the finger of the operator, care should be taken not to sever the walls of the rectum. The finger is then hooked beneath the rectum, which is gently pulled out of the cut. The pulling is continued and the rest of the intestines come away with the rectum, the small intestines being cut off near the gizzard by means of a knife with a blade at least 3 inches long. Care should be taken not to break the intestines when pulling them out. When the small intestines have been severed they will all hang from the vent, which is then cut completely around.

The opening made when the foregoing method is well performed is small; in a fat fowl it is hardly noticeable, as it is readily closed while the walls of the abdomen are still soft and plastic.

45. In removing all the entrails from a fowl, the crop is the first organ to be taken out. To accomplish this quickly the carcass is placed in the position shown in Fig. 21. The entire crop and its attachments should be taken out, and care should be exercised to prevent the leakage of any portion of their contents into or on the carcass of the fowl. The work of removing the crop really begins when the skin and flesh on the neck an inch or two below the head are severed. When this is done, care should be taken to see that the windpipe and the esophagus, or gullet, are not severed, but are loosened from the head with the fingers. After this has been done, the flesh at the throat is cut so that the fowl can be opened up as shown in Fig. 21. When the opening has been made, the gullet is followed with the fingers to and beyond the crop and loosened; the middle finger of the right hand is next pushed through the opening of the neck and the ends of the gullet and windpipe loosened. The crop, windpipe, and gullet can then be removed by taking hold of the gullet and windpipe and giving a pull.

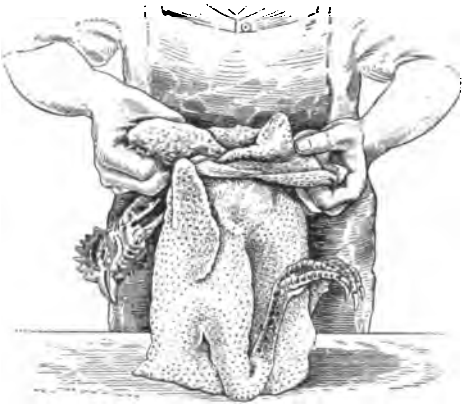


Fig. 21

46. After the crop and its appendages have been taken away the finger is again pushed into the opening in the neck and the lungs and other entrails loosened from the inside of the fowl, as far down as the finger will reach, the fowl being turned so as to loosen all the internal organs at the front. The fowl is then reversed and a cut is made across the abdomen below the vent; the rectum and intestines are then pulled out and cut off and the vent cut out as shown in Fig. 22. The hand is then worked slowly inside of the carcass and about the entrails until they are loosened from the body. When this has been well done all the entrails will be completely loosened and can be taken out in one mass. The inside of the fowl should then be rinsed clean with cold water. The liver should be examined; if it is red and free from spots, it may be used as food; if it is brown, yellow, or spotted, or of any other color than red, it should be thrown away, as these colors indicate that it is unfit for food. The heart and gizzard should be cleaned, washed, and laid on a plate or saucer to drain; after this they should be wrapped, with the liver, if it is good, in paraffin paper and placed inside the fowl. They should never be put loose inside the fowl, for if they are placed in contact with the fowl's flesh decomposition begins quickly.

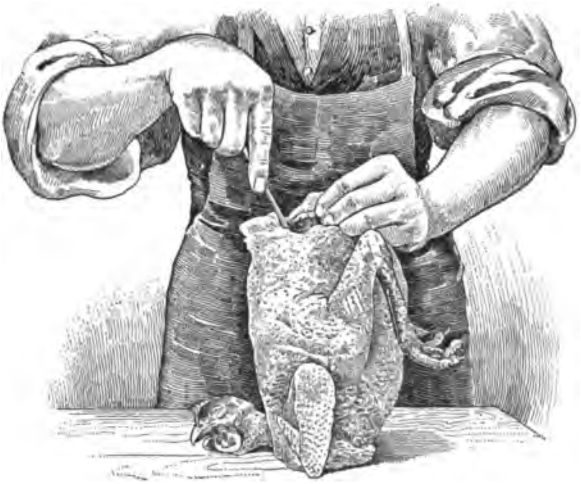


FIG. 22

47. Trimming of Poultry.—The trimming of poultry consists of three main operations: removing the head and part of the neck; removing the tendons, or sinews; and removing the feet and all or part of the shanks.

48. The removing of the head and part of the neck is accomplished by cutting through the back of the neck an inch or two below the head and severing the backbone, after which the gullet and the wind pipe are loosened from the head with the fingers. When this has been done, the skin and flesh is cut all around the neck an inch or so below the head. This will disconnect the head from the body and leave the windpipe and gullet sticking out of the end of the neck. If the dressing of the fowl is to be carried on further, the skin on the back of the neck is then slit down to the point where the neck joins the body, and after the crop is taken out the end of the neck can be tucked into the opening in the body and the opening covered with the loose skin.

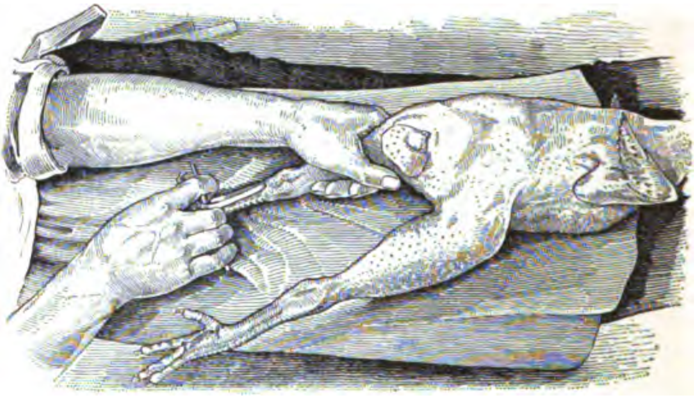


FIG. 23

49. The removal of the sinews, or tendons, from each leg of the fowl will greatly improve the meat of the leg, or drumstick. There are eight tendons in each leg, and they extend from the toes up through the shank and leg into the thigh. To remove them, the skin is cut on the inside of the shank right below the hock joint, and just enough to expose the tendons to view, care being taken not to cut them. The tendons are then raised one or two at a time or all at once with an iron skewer, a sharpening steel, or some such implement, and are drawn out by pulling on them as shown in Fig. 23. The tendons are firmly attached at the shanks, but are much easier to loosen and remove from the thigh muscles. The tendons are readily removed from young fowls, but it is difficult to remove them from old birds.

The tendons of turkeys that are more than 1 year old are brittle and the skewer or other implement used should be carefully pushed under the tendons so as not to break them; the implement should then be turned around gently two or three times to start the tendons, after which they can generally be removed without much difficulty. If the tendons cling tightly to the leg, only one or two of them should be drawn out at one time. Where much of this work is to be done, it will be convenient to use a hook fastened to the wall. In this case, the point of the hook is slipped under the tendons just as is done with the skewer; one hard pull will bring them out. The fowl's leg must be held firmly in the hand, and the pull must be so made as to avoid tearing the leg from the body of the fowl.

50. The removal of the feet and part or all of the shanks is simple and requires no explanation. The advantage of removing only part of the shanks lies in the fact that the meat above the hock joint will not pull away from the joint when the fowl is cooked if the shanks are trimmed in this way. A fowl with only part of the shanks removed is shown in Fig. 27.

The appearance of a fowl will be improved by trimming off the wing points and all loose skin not needed.

51. Trussing of Poultry.—Before trussing a bird, the wish bone, or merrythought as it is called in England, is frequently removed, and the wings of turkeys are disjointed in some cases. By so doing, the carving of unbroken pieces from the entire breast bone, and from the neck as well, is made possible. To remove the wish bone, a cut is made in that portion of the flesh which follows the shape of the bone; the bone can then be broken away from the base of the neck and removed. When it is desired to disjoint the wing of a turkey, the wing should be cut around just above the place at which it joins the body; this enables the skin to be turned back from the wing joint so that the wing can be taken out of its socket. The skin is then drawn over the opening and sewed up.

Frequently it is only necessary to shape the fowl and turn the tips of its wings under its back as shown in Fig. 24; when this is done the entire carcass should be rinsed inside and outside with cold water, the surface dried with a clean cloth, and the body wrapped in white cloth or paraffin paper ready for delivery.

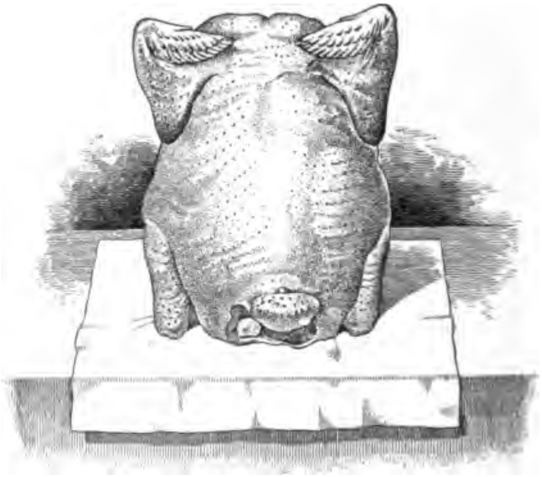


FIG. 24

52. To truss well and quickly, the operator should be supplied with a strong white cord and an 8-inch needle like that shown in Fig. 25; or a needle such as is used to sew sacking or burlap.

There are several ways of fastening the legs and wings of a fowl in trussing it. The simplest way of trussing is to pass the needle and thread through the flesh below the breast bone at the point just above the drumsticks and around the back of the fowl, and tie the thread tightly. The needle and thread is then passed through the folded wings, which are tied in a similar way.

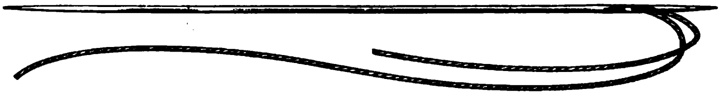


FIG. 25

53. A slightly different way of trussing is to pass the needle and thread through the hole *a* in the backbone shown in Fig. 26, instead of through the flesh below the backbone. This will raise the legs a little higher than would be the case by the other method. The wings are trussed as before.

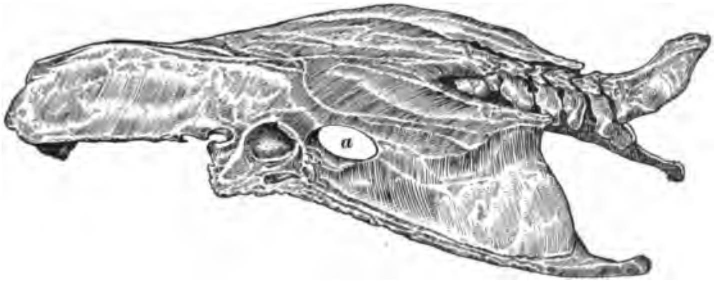


Fig. 26

54. Neither of the foregoing methods is as good as the following, which is recommended: To truss the wings, draw the thread through the flesh at the point *c*, Fig. 27; pass it through both pinions, or tips, of the folded wings, and through the point corresponding to *c* on the other side of the fowl. Draw the thread again through the pinions to the starting point and tie tightly. To truss the legs, pass the thread through the body at the point *a* (which is an inch, more or less, wide, according to the size of the fowl) and below the middle line of the drumsticks *b*; then pass the thread over the drum-

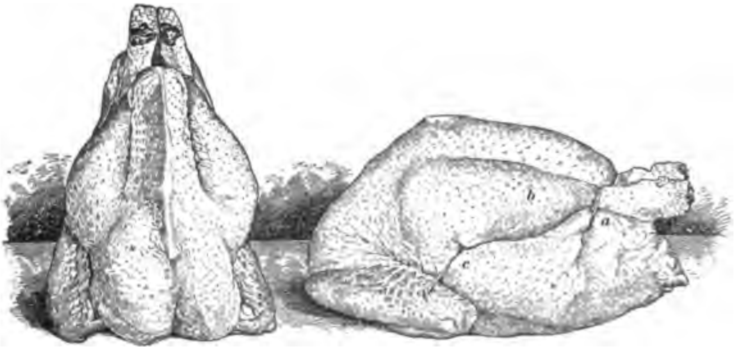


Fig. 27

stick and across to the other side, letting the thread go under the point of the breast bone. Draw the ends of the cord tightly and tie them together near the point of entrance *a*; this holds the wings and legs in position while roasting.

PACKING OF DRESSED POULTRY FOR SHIPMENT

55. Importance of Proper Packing.—As the prime object of raising poultry is to gain the largest possible profit, poultry should never be killed until it is in the best possible physical condition but it should always be packed for market in such a way that it will remain in good condition and look attractive. Too much care and attention cannot be given to the preparation of dressed poultry for market, as a large proportion of loss in selling comes as a direct result of poor preparation.

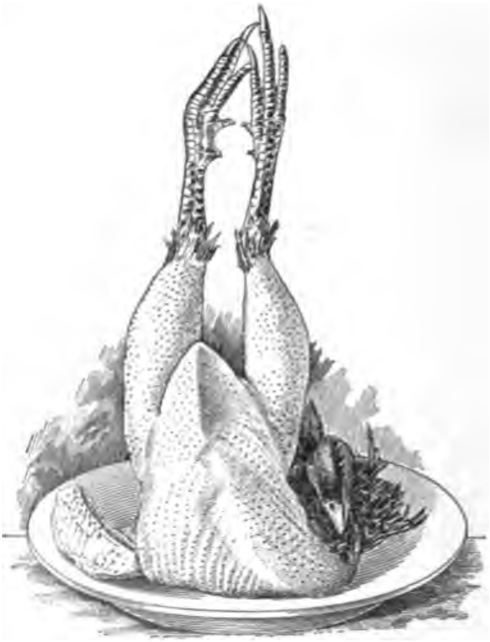


FIG. 28

In packing poultry it is always the best practice to put only birds of the same class together, in order to maintain a uniform appearance of the poultry in each package. Old and young fowls, birds of assorted sizes, or birds of different quality should never be placed in the same package. If different grades of poultry are packed in one package the entire lot always sells for the price of the lowest grade. No package of poultry can be graded as first class unless every specimen in the package is first class.

56. It is always advisable to ship at least the better grades of poultry, in boxes or barrels. If shipped in this way, the poultry will reach its destination in the best condition, because the fowls will not have to be handled by the legs. If poultry has to be handled continually in transit, it will not only become dirty but it will also assume a stretched appearance, which will make it look as if it were thin in flesh and made up of a large percentage of offal. Although the appearance of a stretched fowl can be improved on arrival at its destination, the operation adds to the expense of marketing and detracts from the profit of the shipper. It is much more profitable for the producer to have his product arrive in the market in prime condition.

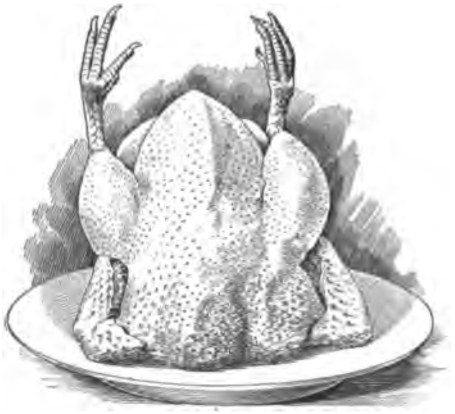


Fig. 29

57. The result of the rough handling that unpacked poultry receives during shipment is shown in Fig. 28. This carcass has been so badly handled that it appears unevenly formed. Fig. 29 shows the same carcass after it has been worked up into shape again by proper manipulation. As such shaping has to be done in the market, the producer gets a very low price for what would otherwise sell for a good quality fowl, and this profit goes into the pocket of the dealer.

To improve the appearance of a fowl that has been stretched by improper handling, turn the points of the wings under the body, force the shanks and feet down, push the thighs forward, and turn the head to one side. Then press the carcass with the hands until it assumes a rounded appearance.

58. All packages of dressed poultry that are sent to market should be addressed and marked in a manner similar to that shown in the card that follows:

DRESSED POULTRY
(FOR) JOHN BROWN
78 CHAMBERS STREET
NEW YORK CITY
5 LB. ROASTERS
THIS END UP

59. Cooling and Washing for Packing.—As soon as the carcass of a fowl has been dressed, it should be submerged in cold water and left there until well cooled through and the body heat is entirely gone. It should then be transferred to ice water and left there until the meat is thoroughly chilled. At all times, except when refrigeration is used or during the winter months when the weather is cold, the carcass should be left in the ice water until a few hours before shipping. When it is taken from the ice water, all dirt and blood stains should be cleaned from the feet, shanks, and head. If any feathers are left on the shanks and toes, particular attention should be given to washing them clean. The body should then be dried with a cloth, when it is ready for sale, storage, or packing.

METHODS OF PACKING

60. Dressed poultry is commonly prepared for shipment to market by packing in three ways: packing without refrigeration, packing for refrigeration above freezing, and packing for refrigeration below freezing. The three methods give satisfactory results when they are used under proper conditions. **Refrigeration** of poultry is its cooling by artificial means to a point above or below freezing, and is commonly known as *cold storage*. When ice is placed inside of a package containing poultry, the poultry is usually spoken of as iced poultry.

61. Packing Without Refrigeration.—When poultry is to be sent to near-by points—points that can be reached overnight—it is prepared for shipment by packing without refrigeration. It is customary to wrap each fowl in a separate sheet of paraffin paper and pack a number tightly together in a clean box lined with the same kind of paper.

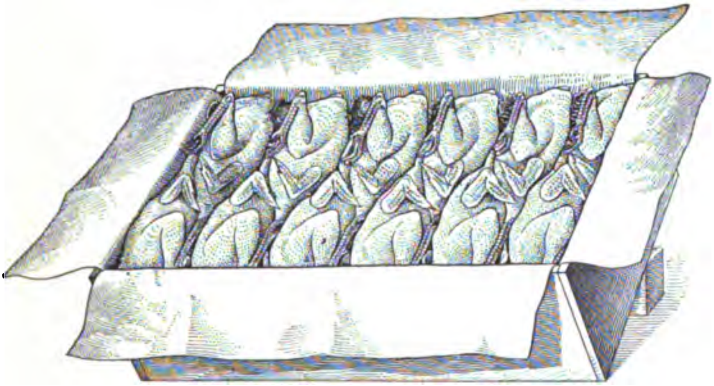


FIG. 30

The boxes most commonly used for this purpose are made shallow so as to hold only one or two layers of fowls, and are made of white wood. Some boxes are large enough to hold three dozen birds in one layer, other boxes are made to hold from two to three dozen birds in all, the number depending on the weight of the fowls. A box 3 feet long, 17 inches wide, and 7 inches deep is well suited for holding twenty-four 5-pound roasters. A filled box of this size is shown in Fig. 30. The box is lined with white paper, and the fowls after being thoroughly chilled are packed in the box two layers deep.

Fowls packed in this way will not be injured by a night's travel in an ordinary freight car during cold weather.

62. Packing for Refrigeration Above Freezing.—When poultry is to be sent a long distance or when it is to be shipped during warm weather, ice must be placed in the box or barrel in which the fowls are packed, or the box or barrel must be shipped in a refrigerator car or in the refrigerator in the hold of a ship. In packing poultry with ice, the bottom of the box or barrel is first covered with ice, and then alternate layers of poultry and ice are packed in to within about 10 inches of the top. The last 10 inches is filled with pieces of ice that weigh about a pound each, and the top is fastened down tightly.

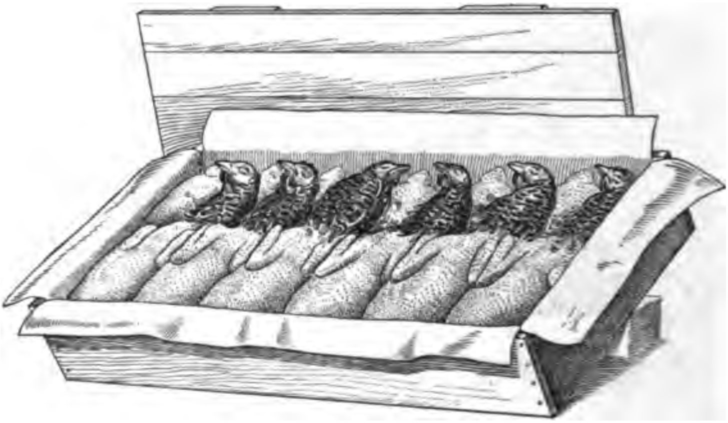


FIG. 31

63. A package suitable for poultry that is to be shipped in refrigerator cars, in ship's refrigerators for export, or is to be placed in cold storage is shown in Fig. 31. The partly filled box shown in Fig. 32 illustrates the method of packing the bottom layer of fowls. The top layer is packed feet down, thus bringing the back of the fowls into view when the lid is taken from the box. Fowls that have been nicely fattened will sell remarkably well when exposed for sale in this manner, as a plump back gives full assurance of a plentiful supply of nutritious meat on the fowl. Another advantage of this manner of packing is that the carcasses of the fowls are molded into an attractive shape, and when exposed to view, they will have the appearance shown in Fig. 31. The forcing together of the fowls in the box plumps the body and fills out the back.

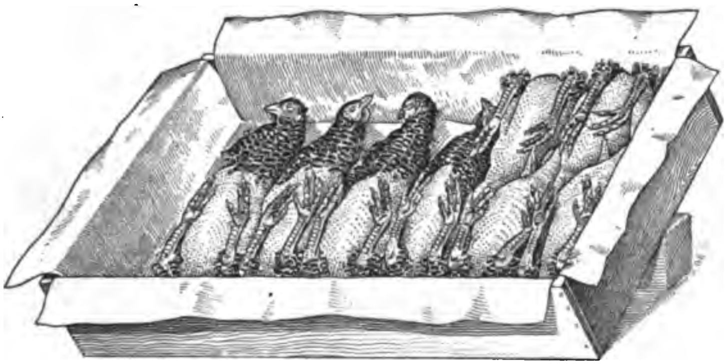


FIG. 32

Packages like those shown in Figs. 31 and 32 may be kept for a long time in cold storage and the poultry packed in them will remain suitable for food. Or they may be safely sent all over the world if kept constantly in the refrigerator boxes. When packed in this way and without ice they come out of cold storage in prime condition; in fact, there should be no change in the condition of poultry in cold storage. The main cause of deterioration in poultry kept in cold storage is irregular temperature by changing from cold to warm places. So long as the poultry is kept at a uniform temperature or constantly frozen, it will keep well.

64. Packing Poultry for Refrigeration Below Freezing. Smaller packages are usually used to pack poultry for the purpose of freezing in cold storage and for shipment while frozen. Such packages are shown in Fig. 33. The openings in the sides of the boxes are for ventilation, and to prevent the collection of moisture, which might favor injurious conditions inside the case. These packages are made to hold twelve fowls of fair size. As shown, the fowls are packed back to back. The box opens at the middle and when the halves of the box are laid back and its contents exposed for sale each half dozen is exhibited in a very attractive manner.

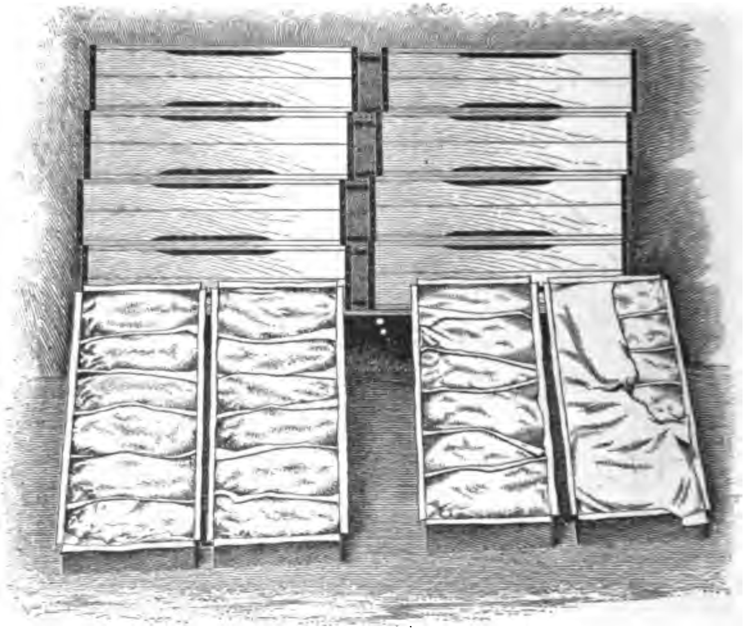


FIG. 33

This method of packing is largely used in Australia, from which country many hundreds of tons of dressed poultry are annually shipped in a frozen condition to European markets. Only fowls that were in perfect health when killed should be packed together in this way, and they should be placed in cold storage at a low temperature or frozen immediately after being killed. One specimen of diseased or otherwse contaminated poultry will not only reduce the value of all in the package but perhaps render them unfit for food.

65. Handling of Cold-Storage Poultry.—When well frozen and handled properly, poultry will have an appearance that will be as attractive as the appearance of that which has not been frozen; but when poultry of poor quality has been frozen in a careless way, the result will more than likely be unsatisfactory. Selected specimens that have been well fed, properly killed, thoroughly plucked, and carefully packed, will keep for an indefinite length of time if well frozen and kept frozen continually. They will come out of their period of freezing refrigeration in as good condition as when they were placed in it. The fowls shown in Fig. 34 were shipped in a frozen condition from Australia and were kept in that condition for several months.

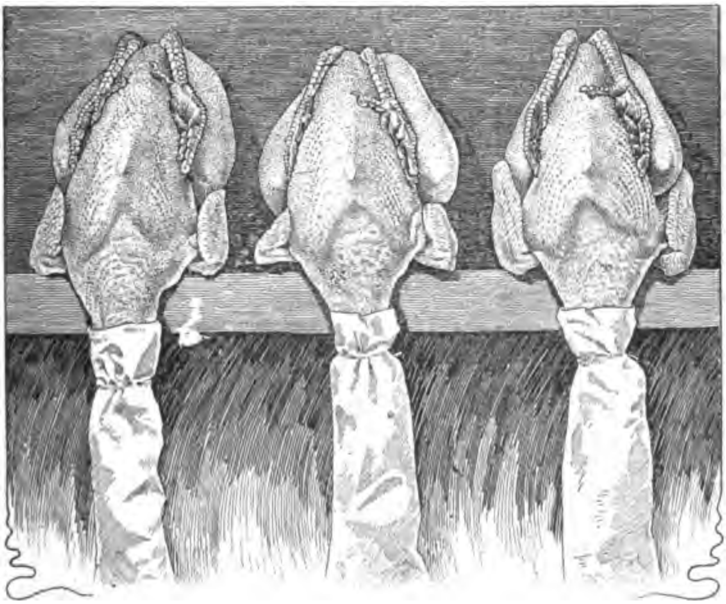


FIG. 34

66. Poultry is not injured when it is cooled or frozen and kept in this condition for a long period of time. If damage does occur, it is done through the handling of the poultry after it is taken from a low temperature. When taken from cold storage, either frozen or unfrozen, poultry should be permitted to thaw slowly in a temperature ranging between 35 F.° and 50 F.° It is bad practice to expose poultry to a warm atmosphere or to put it into warm or even cool water immediately after it is removed from a temperature around freezing. The frequent dipping of dressed poultry into salt brine or alum water improves its appearance temporarily but greatly injures its food value. Frozen poultry should be delivered to the consumer in a frozen condition; it should then be thawed out and immediately prepared for cooking.

A little careless handling will, however, quickly destroy the food value of poultry that is in practically perfect condition when taken from a freezing temperature. If it is exposed to a very sudden rise in temperature so that it will "sweat," or if it is immersed in water to drive out the frost, the activity of bacteria and molds that are everywhere present will be fostered and decay will commence immediately. For instance, if a large mass of frozen poultry is piled up in a heap in a warm room and allowed to thaw rapidly, it will quickly become moldy and decayed and unfit for food.

All frozen poultry that was of good quality before it was placed in storage and that was properly handled during the time it remained in storage and after it was taken from storage, will be in good condition for use as food. The greatest loss from frozen and cold-storage poultry comes from the unintelligent handling of poultry after it is taken out of a freezing temperature. Many dealers attempt to attribute the consequences of their own errors to cold storage or the ill effects of freezing poultry, but the fault lies rather in their ignorance or carelessness than in any fault of the system of cold storage.

67. The carcasses of fowls that have been ailing with roup or other infectious diseases are unfit for food. Such carcasses, even when frozen, will deteriorate quickly and contaminate good fowls that are packed in the same case with them. There is a marked difference between roup and a slight cold. Fowls affected with roup have a fetid odor that is not present in fowls that have only a cold. Only the carcasses of fowls that are perfectly healthy should be used for food.

SELLING OF POULTRY

POULTRY PRICES

68. To gain the most profit from the production of market poultry, the poultryman must cater to the trade that is willing to pay the highest prices for the best quality, and must have his product ready for market when there is the greatest demand for it, at which time the prices are highest. In order to accomplish this it is necessary for him to become proficient in feeding.

An inspection of market prices for a number of years back shows plainly that market poultry of good quality will sell at high prices from the middle of December to the end of June. This is due to a large extent to the disappearance of farm-grown poultry from the market during these months.

69. The relative selling price per pound, live weight, plucked weight, and drawn weight of the same fowl, is shown in Table I. The plucked weight is the weight of the fowl with the feathers removed but with the head and feet left on. The drawn weight is the weight with the head, feet, and entrails removed and the fowl ready for cooking. It will be seen from this table that the selling price per pound, plucked weight, is about 33⅓ per cent. more than the live weight, and that the price per pound, drawn weight, is about 100 per cent. greater than for the live weight, and about 50 per cent. greater than for the plucked weight. This increase in the selling price is due, of course, to the removal of the waste parts and also to the labor entailed. The table furnishes a guide to decide the price to be fixed on the plucked or drawn weight of any grade of poultry.

70. As has been previously pointed out, quality is the governing factor in the prices paid for market poultry. Fowls that are thin in flesh and thus have a large percentage of waste, will sell only at low prices, grading from about 9 to 12 cents per pound, live weight, in American markets. These are the prevailing prices for the bulk of the poultry raised on the great majority of farms. But the better grades of poultry bring considerably above 20 cents per pound, live weight, in nearly all localities.

The buyer practically makes the prices for the lower grades of poultry, but the producer can to a considerable extent govern the prices paid for the better grades. Although at times there is such a limited demand for the low grades of poultry as to force their sale at an actual loss, there is always a brisk demand for a good quality of poultry. Buyers in the wholesale markets always prefer to obtain the better grades of market poultry at the higher prices, because the better grades will always sell quickly and at a profit.

TABLE I

MARKET VALUE OF FOWLS AT DIFFERENT STAGES

Live Weight Cents per Pound	Plucked Weight Cents per Pound	Drawn Weight Cents per Pound
9	12¼	18¼
10	13½	20
11	14½	22
12	16	23½

71. Dressed small broilers and 4-pound roasters will sell best in the average market. Fryers and heavy-weight broilers come largely at a time when all kinds of poultry are plentiful and hence sell at prices for which it would not pay to raise broilers or roasters. As stated before, roasters can be produced at a profit in any locality where they can be sold for 20 cents a pound, live weight.

For about 4 months in the year the markets are crowded with poultry; for the rest of the time there is a relatively smaller supply and prices are correspondingly higher. During the fall when hens do not lay well and when young stock begins to mature, prices are naturally low, because all the farmers who raise poultry sell their surplus at this time.

SELLING OF LIVE POULTRY

72. Gathering of Live Poultry.—The great mass of poultry that is sent to the city markets is obtained from rural localities by collectors who make a business of gathering up live fowls and taking them to some central point, from which they are shipped in car-load lots to market. The traffic in live poultry is very large. At certain seasons of the year there is less demand for live poultry than at other times, in which case it will not pay to ship it directly to market, and it is shipped to fattening houses where a specialty is made of fattening poultry. The period of lowest prices is from October to the middle of December, as would naturally be expected because of the fact that at this time there is the greatest willingness to sell.

Farmers who raise poultry in districts where there is a well-established system of collection can usually secure good prices for their product, because of the competition that results from having a number of buyers in the field. It is usually more profitable for the man who is raising poultry on a small scale in localities where there is a well-established system of collection to sell his poultry alive, unless he is close to a town where there is an active retail trade.

73. Shipping of Live Poultry.—When sold to be sent away, live poultry should be boxed in crates best suited for this purpose. Poultry shipped in boxes that are filthy, broken, or too small will invariably be sold at a loss. As with dressed fowls, the appearance of live poultry has its influence on price, and unsightly packing will frequently be responsible for slow sales and low prices. Shipping crates for live chickens and live ducks should be 3 feet long, 2 feet wide, and 1 foot high,

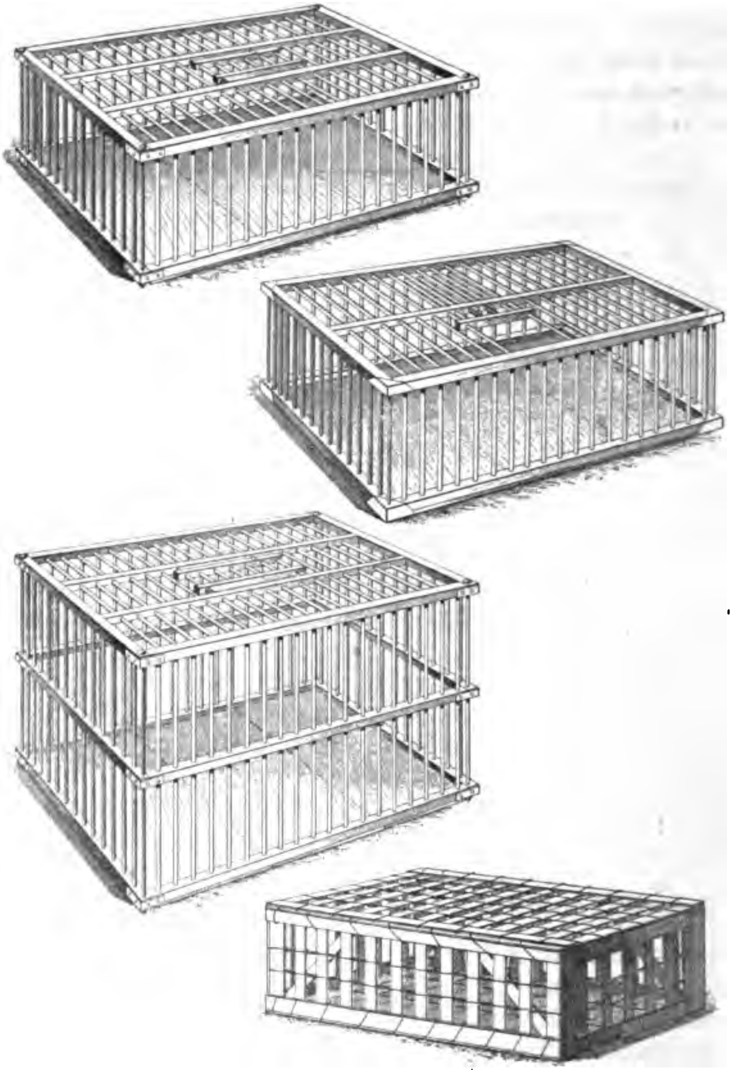


Fig. 35

and those for turkeys and geese should be 24 inches high. Several patterns of crates are illustrated in Fig. 35. Crates that will do as well as those shown can be made at home; they should, however, conform with them in size, shape, and proportions. The danger of shipping poultry in crates that are too small lies in the fact that the fowls become bruised or smothered, and those that live reach the market in bad condition and sell for little.

The best days of the week for live poultry to arrive at its destination are Wednesdays and Thursdays. All the birds in each crate should be of uniform size, age, and color. When sent in this way, fowls are apt to sell for more than when packed promiscuously. The floor of the crate should be clean and the fowls should be fed all the whole corn they will eat before they are put into the crates; and when the fowls are to go a long distance, a can filled with whole corn should be fastened against the sides and inside of all crates so that the fowls will not become hungry in transit.

SELLING OF DRESSED POULTRY

74. The greatest difficulty in selling poultry will be experienced in places where there is no regular demand for poultry, either for local consumption or for shipment to other localities. Where such conditions as these exist, those who raise poultry should learn to raise only the very best, and they should also form a local organization for gathering and shipping the fowls.

Under such conditions, as well as under the most encouraging ones, great advantage will be found in having the poultry well grown, beautifully dressed, and sent to market displayed in such an attractive manner as to impress prospective buyers favorably. Poultry that is invitingly presented to the view will sell well in any locality, and it can be sent to the markets of other places with full assurance of profitable returns.

75. Dressed poultry should always arrive in a city market early in the morning. It is a great advantage if the poultry raiser is close enough to his market to ship his poultry on the afternoon or evening of one day so that it will arrive in the market early the next morning, in which case it can be shipped without being iced.

The reason for the desirability of having poultry arrive in the market in the early hours of the morning is that most of the business in city wholesale markets is done from 1 or 2 A. M. until 5 or 8 A. M. If poultry arrives during these hours and is of even fair quality it will ordinarily be promptly sold, but if it arrives later in the morning the probability of its being sold that day will be slight. In this case it will have to wait until the following morning before it can be disposed of, and will run a chance of deteriorating in quality.

76. It should be firmly impressed on the mind of the poultry raiser that wherever there is an opportunity to sell direct to the consumer he should use every means of preparation and presentation that can be made use of to improve the appearance of the fowls offered for sale. Shaping, trussing, and delivering in attractive form will add to its value. The most important qualities of market poultry are a plump appearance, softness of meat, and cleanliness. Fowls should be delivered within 24 hours after killing. They should be thoroughly cooled, but not placed in water after being dry-plucked. The best market poultry should never be frozen.

77. When ready for delivery, the carcass should be wrapped either in a clean cloth or paraffin paper and be placed in a basket. Baskets that will hold three or four fowls are the most convenient for delivery, and when the fowls are packed in this way they are very attractive. Baskets that are too large, too small, or unsuited for this use should be avoided. It should be borne in mind that the value of dressed fowls is increased by attractive packing, while packing that is unattractive lessens their value.

A trade that should become profitable is the daily or weekly delivery of market poultry and fresh eggs direct to consumers.

No other food products are more attractive than freshly plucked poultry that is soft-meated and well-dressed for cooking, and clean fresh eggs.

78. The preparation of fowls for market is a factor of great importance in poultry farming, for when it is well done, it not only adds to the appearance of the product but to the quality of the flesh as well. At least half the value of market poultry that sells for a high price results from proper preparation, which includes the right methods of feeding from the time the chick is hatched, the fattening for market, and the killing, plucking, trussing, and packing for delivery. When all these operations have been properly done, a chicken will sell for from 28 to 36 cents a pound, and a young turkey of best quality equally well prepared will sell for as high as 42 cents a pound. These prices are obtained only in the markets of large cities, or by those who sell direct to those who desire the best for their tables.

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NOTE.—All items in this index refer first to the section (see the Preface) and then to the page of the section. Thus, "Adobe poultry house, §2, p33," means that adobe poultry house will be found on page 33 of section 2.

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